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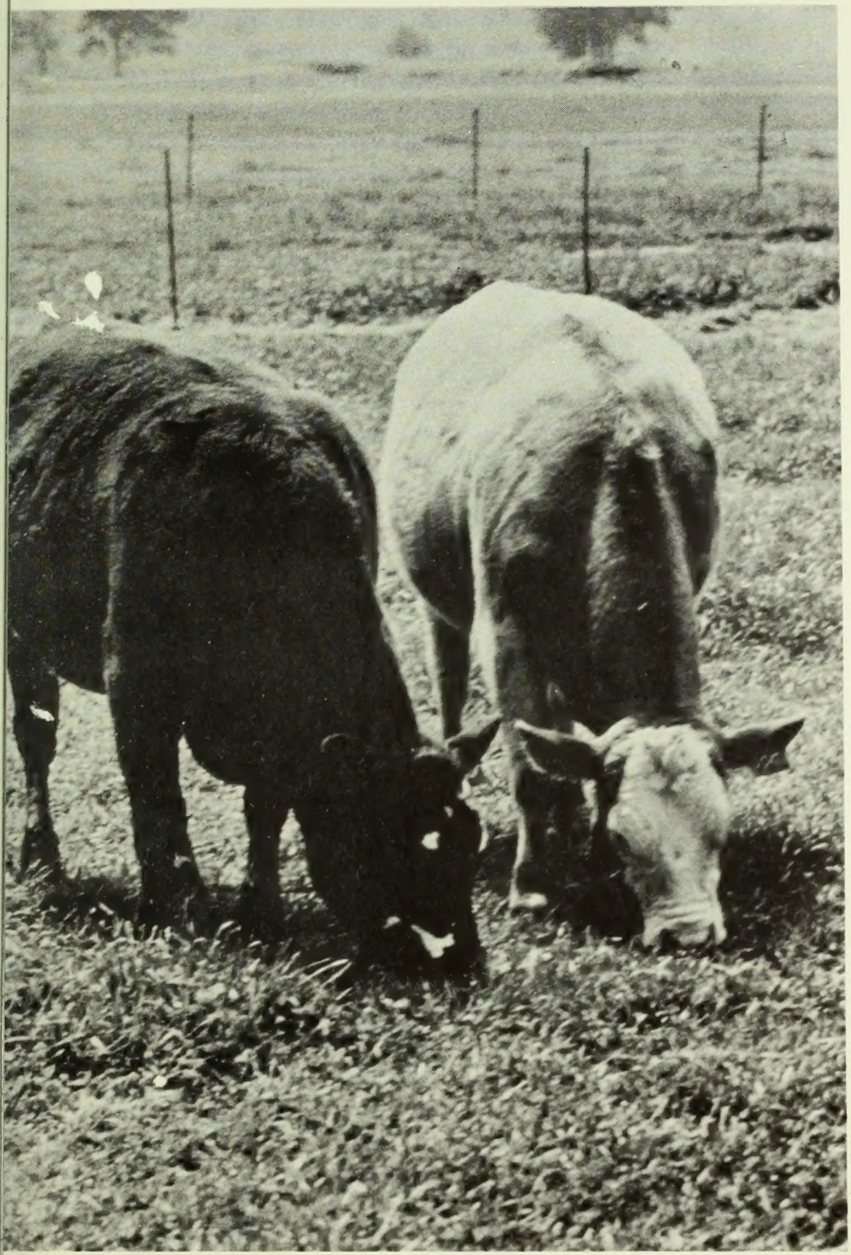

Effect of Nitrogen Levels and Stocking Rates on Profitability of Winter Grazing

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Effect of Nitrogen Levels and Stocking Rates on Profitability of Winter Grazing

Numerous studies over many ears have demonstrated the rofitability of grazing lighteight yearling cattle on winter asture in the lower south. Winter razing research has been conucted at the MAFES Brown Loam ranch Experiment Station located southwest of Jackson) for he last 26 years. During this eriod, net returns to land, labor, nd management have ranged from -$92 to +$186 per acre, with a 26 year average of $62 per acre. Losses occurred in only four of the 26 years, three due to extreme cold and one to a high negative margin between calf buying and selling price.

The winter grazing research program at the Brown Loam Station in the last 15 years has been to graze 1.5 steer calves (540 lb/acre) on wheat-ryegrass pasture planted on a prepared seedbed and fertilized with 120-60-60 (N-P_2O_5-K_2O). Pastures were generally planted the second week in September, with grazing beginning the second week in November. This procedure usually resulted in 180 to 200 grazing days, with approximately 500 pounds of animal gain per acre.

In an attempt to increase net returns from the winter grazing practice, a study was designed to evaluate higher nitrogen and stocking rates than have customarily been used. Small plot studies have demonstrated that ryegrass will give a yield increase up to at least 400 pounds of nitrogen per acre. This increased production apparently would support a higher stocking rate. The question then becomes, what level of nitrogen and stocking rate would be the most profitable?

The objectives of this study were to evaluate three levels of nitrogen (148, 229, and 331 pounds per acre) and determine what stocking rates would most profitably utilize the forage produced. Previous studies have shown that 1.5 steers weighing 350 pounds per head can be grazed for the entire grazing period on pasture that has been fertilized with 120-130 pounds of nitrogen per acre---with little or no supplemental feed. Increasing the amount of nitrogen above this level will produce more forage in the fall and spring but during mid-winter, when the growth of wheat and ryegrass essentially stops, it would be difficult to graze more than 1.5 calves per acre. Therefore, alternative grazing management systems that called for removal of some or all of the cattle were designed so there would not be more than 1.5 animals per acre during the mid-winter period.

Experimental Procedure

Three grazing management systems were used for each of three levels of nitrogen during 1970-71, 1971-72, 1972-73, and 1973-74. The first two grazing management systems consisted of removing all but 1.5 steers per acre to drylot feeding. This was done about mid-December---in time to allow the 1.5 steers to remain on pasture without supplementary feed during the midwinter period. The other grazing management system allowed the cattle to graze until the forage supply was exhausted (usually about early January). All cattle were then moved to drylot feeding until the grass had enough regrowth to allow restocking. Reasons for comparing these grazing management systems were that previous work demonstrated that some feeding would be required with higher stocking rates, and some researchers had suggested the feeding period could be shortened if all cattle were removed---allowing a faster regrowth of the grass.

The resulting nine systems (Table 1) were: Systems 1, 2, and 3 received the lowest nitrogen level---148 pounds per acre. System 1 was stocked with 1.5 steers (540 lb/acre) for the duration of the season. System 2 was stocked with 2.0 steers (720 lb/acre) and, when the forage supply became short, a 0.5 steer equivalent was removed to

Table 1. Nitrogen levels, stocking rates, and grazing management systems, winter grazing study, MAFES Brown Loam Branch Station, 1970-74.

Systems	Nitrogen Level Lbs./A.	Stocking Rate Steers/A.	 Lbs./A.	Grazing Management Steers/A.
1	148	1.5	540	Remove 0
2	148	2.0	720	Remove 0.5
3	148	2.0	720	Remove all
4	229	2.0	720	Remove 0.5
5	229	2.5	900	Remove 1.0
6	229	2.5	900	Remove all
7	331	2.5	900	Remove 1.0
8	331	3.0	1,080	Remove 1.5
9	331	3.0	1,080	Remove all

drylot feeding until the forage had regrown. System 3 was stocked with 2.0 (720 lb/acre) steers that were allowed to graze until the forage supply was exhausted. All steers were then removed to drylot feeding until the forage had regrown enough to allow restocking. Systems 4, 5, and 6 received 229 pounds of nitrogen per acre and were stocked at 2.0, 2.5, and 2.5 steers per acre. Systems 7, 8, and 9 received 331 pounds of nitrogen per acre and were stocked at 2.5, 3.0, and 3.0 steers per acre. Grazing management for systems 4-6 and 7-9 paralleled that of systems 1-3 (Table 1).

Nine 6-acre plots were fallowed during summer each year and planted to wheat-ryegrass at the rate of 90 pounds of wheat and 20 pounds of ryegrass. Wheat was planted with a grain drill and ryegrass with a cultipacker seeder. All P_2O_5 and K_2O was applied before planting. Nitrogen applications were made at planting, December 1, February 15, and April 1. Hereford steer calves with an average weight of 361 pounds were used as test animals. Average stocking date was November 8. Data were analyzed as a RCB using four years as replications.

To make the economic data more relevant, cost data were calculated using 1976 input prices. (Current costs are about 35% higher than 1970-74 budgeted expenses.) Estimated annual production expenses for wheat-ryegrass pasture for the three levels of nitrogen are presented in Table 2. Miscellaneous expenses not included in pasture cost are presented in Table 3. The daily ration whi cattle were off pasture was 3 pounds of corn silage and 4.2 pounds of ground shelled corn pe head. Daily cost was 46 cents pe head.

A purchase price of $38.08/cw was used to calculate total cost pe grazing system. This is the averag price paid for this grade of catt over the last 10-year period.

Table 2. Estimated Annual Expenses Per Acre For Wheat-Ryegrass Winter Pasture On Prepared Seedbed, Mississippi, 1976.

Item	Unit	Number of units	Price per unit	Total Amount
Seed				
Wheat	lb.	90	$ .10	$ 9.00
Ryegrass	lb.	20	.18	3.60
Tractor & Equip.	acre	1	9.40	9.40
Lime	ton	0.2	15.00	3.00
Fertilizer				
P2O5	lb.	61	.19	11.59
K2O	lb.	61	.09	5.49
Nitrogen	lb.	148	.18	26.64
Nitrogen	lb.	229	.18	41.22
Nitrogen	lb.	331	.18	59.58
Total Expenses Per Acre: 148 lb. N Level				68.36
229 lb. N Level				82.94
331 lb. N Level				101.30

Table 3. Miscellaneous expenses, winter grazing study, MAFES Brown Loam Branch Station, 1970-74.

Interest	9% annual rate for 9 mos. on pasture cost and initial animal cost.
Death Loss	3% of initial animal cost.
Marketing & Transportation	$11.00/head
Veterinary & Medicine	5.00/head
Salt & Minerals	0.50/head
Supplementary Feed	0.46/head daily while off pasture
Daily Ration & Cost	32 lbs. urea-cornsilage @ $16.00/T. and 4.25 lbs. of ground shelled corn @ $2.75/bu.

Brown Loam steers on winter pastures.

Results and Discussion

Total beef production per acre increased with increasing nitrogen levels and stocking rates---from 555 pounds per acre with the low nitrogen level and stocking rate to 918 pounds per acre with the high nitrogen level and stocking rate (Table 4). In every case, the higher stocking rate and higher level of nitrogen produced greater gains per acre.

Average gain per steer generally decreased with increasing stocking rates (Table 5). Nitrogen levels generally had less influence than stocking rate on gain per animal. Although there were few significant differences, the lower stocking rates and grazing management systems where part of the cattle were left on pasture generally had higher gains per animal.

The number of grazing days per acre generally followed the same trend as total gain per acre (Table 6). As the nitrogen level increased, more grazing days resulted. Within each level of nitrogen the lower stocking rate gave a lower number of grazing days per acre. The grazing management systems where part of the cattle remained on the grazing plot all the time had a higher number of grazing days per steer than where all cattle were removed.

Table 4. Average total gain per acre, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.

System	Nitrogen Level Lbs/Ac.	Pounds/Acre[1]
8	331	918 a
9	331	848 b
7	331	798 c
6	229	767 c
5	229	760 c
4	229	691 d
2	148	642 de
3	148	624 e
1	148	555 f

[1] Means followed by the same letter are not different (P=.05) according to Duncan's New Multiple Range Test.

Table 5. Average gain per steer, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.

System	Nitrogen Level Lbs/Ac.	Pounds[1]
1	148	370 a
4	229	346 ab
2	148	321 bc
7	331	319 c
3	148	312 c
6	229	307 cd
8	331	306 cd
5	229	304 cd
9	331	281 d

[1] Means followed by the same letter are not different (P=.05) according to Duncan's New Multiple Range Test.

Table 6. Average number of grazing days per steer and per acre, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.

System	Per Steer	Per Acre[1]
8	170	511 a
9	156	469 b
7	179	447 bc
5	174	435 c
6	168	421 c
4	192	384 d
2	189	379 d
3	175	350 e
1	209	314 f

[1] Means followed by the same letter are not different (P=.05) according to Duncan's New Multiple Range Test.

Total costs per head increased only slightly as stocking rate and nitrogen level increased; however, cost per acre increased dramatically due to the increased stocking rate (Table 7).

Table 7. Average total cost per steer and per acre, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.

System	Per Steer	Per Acre
1	$219.62	$329.43
2	215.40	430.80
3	219.63	439.26
4	229.97	459.94
5	220.22	450.55
6	222.04	555.10
7	226.72	566.80
8	223.46	670.38
9	226.88	680.64

Calves on winter pasture, May 1962

Yearling steers on winter pasture.

Yearling steers on ryegrass, May 1966.

F_1 heifers on winter pasture, May 1974

Economic Analysis

Two key factors in evaluating the relative profitability of the nine grazing systems are margin (the difference in the buying and selling price per hundredweight of the same cattle) and price of nitrogen. Results obtained in the grazing systems experiment were compared at three margins (negative, zero, and positive) and three prices of nitrogen (9, 18, and 27 cents per pound).

Cattle were assumed to be bought for \$38.08/cwt and sold for either \$34.96, \$38.08, or \$41.20/cwt, giving margins of -\$3.12, 0, or +\$3.12. For the last 10 years this grade of cattle has sold for an average of \$34.96/cwt, resulting in a \$3.12 negative margin. Although the negative margin is more common, the zero and positive margins were used to determine whether the most profitable grazing system would change under the more favorable cattle price situation (Tables 8, 9, and 10).

The more relevant situation under present circumstances is the negative margin and 18 cents per pound nitrogen (center column of Table 8). Returns per acre to land, labor, and management ranged from +\$43 for System 1 to -\$26 for System 9. Three of the four most profitable systems used the low nitrogen level. System 4, which used medium nitrogen and the same stocking rate as System 2, produced the second highest average return.

The nitrogen price of 9 cents per pound (left column of Table 8) extended the number of systems that appeared economically feasible. Except for System 9, which showed a return to land, labor and management of only \$5 per acre, the lowest return was \$29 from System 6. At a nitrogen price of 27 cents per pound (right column of Table 8), only Systems 1, 2, and 4 appeared economically feasible, with net returns of \$29, \$18, and \$13 per acre, respectively.

The effect of the more favorable cattle selling price of \$38.08/cwt was to increase returns across all systems and nitrogen prices (Table 9). Except at the lowest nitrogen price, Systems 1, 2, and 4 were the most profitable.

When the margin was \$3.12/cwt, differentiation between systems was more difficult (Table 10). For example, at 18 cents per pound nitrogen, returns to land, labor and management ranged from \$90 for System 9 to \$130 for System 8. Although no significant differences occurred, Systems 2 and 4 ranked near the top. At a nitrogen price of 9 cents per pound, returns from System 8 were higher than from Systems 1 and 2. At the high nitrogen price, Systems 2 and 4 were slightly more profitable than Systems 1 and 8. The general effect of the positive margin is to favor the higher nitrogen levels and stocking rates.

Table 8. Net returns per acre, three nitrogen costs and negative margin, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.[1] [2]

		Nitrogen Cost			
\$.09/Lb.		\$.18/Lb.		\$.27/Lb.	
System	Return/A (\$)	System	Return/A (\$)	System	Return/A (\$)
1	57 a	1	43 a	1	29 a
4	51 ab	4	35 a	2	18 a
2	46 ab	2	32 ab	4	13 a
7	42 ab	3	17 b	3	3 b
8	41 ab	5	13 b	5	- 9 bc
5	35 ab	6	11 b	6	-11 bc
3	31 b	7	10 b	7	-22 c
6	29 b	8	10 b	8	-23 c
9	5 c	9	-26 c	9	-59 d

[1] Purchase price: \$38.08
Selling price: 34.96
Margin: -3.12

[2] Means in the same column followed by the same letter are not different (P=.05) according to Duncan's New Multiple Range Test.

Table 9. Net returns per acre, three nitrogen costs and zero margin, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.[1] [2]

Nitrogen Cost					
$.09/Lb.		$.18/Lb.		$.27/Lb.	
System	Return/A ($)	System	Return/A ($)	System	Return/A ($)
8	101 ns	4	78 a	1	62 a
4	94 ns	1	76 a	2	59 a
7	93 ns	2	73 a	4	56 a
1	90 ns	8	70 a	3	43 ab
2	87 ns	5	64 a	5	42 ab
5	86 ns	6	62 a	6	40 ab
6	84 ns	7	61 a	8	38 ab
3	72 ns	3	58 a	7	30 ab
9	64 ns	9	32 b	9	0 c

[1] Purchase price: $38.08
Selling price: 38.08
Margin: 0.0

[2] Means in the same column followed by the same letter are not different (P=.05) according to Duncan's New Multiple Range Test.

Table 10. Net returns per acre, three nitrogen costs and positive margin, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.[1] [2]

Nitrogen Cost					
$.09/Lb.		$.18/Lb.		$.27/Lb.	
System	Return/A ($)	System	Return/A ($)	System	Return/A ($)
8	162 a	8	130 ns	2	100 a
7	145 ab	4	121 ns	4	99 a
4	137 abc	2	114 ns	8	98 a
5	136 abc	5	114 ns	1	95 a
6	134 abc	7	113 ns	5	92 a
2	129 abc	6	112 ns	6	90 a
1	124 abc	1	109 ns	3	84 a
9	123 bc	3	98 ns	7	81 ab
3	112 ac	9	90 ns	9	58 b

[1] Purchase price: $38.08
Selling price: 41.20
Margin: 3.12

[2] Means in the same column followed by the same letter are not different (P=.05) according to Duncan's New Multiple Range Test.

Another important determinant of returns is the cattle price level. Returns to land, labor and management from the nine grazing systems, using margins of -$3.12, 0, and +$3.12 per cwt and buying prices of $33.08, $38.08, and $43.08 are presented in Table 11. The higher price level resulted in greater net returns. Within a price level, systems with lower stocking rates generally ranked near the top when a negative margin was considered. Positive margins tend to favor the systems with higher stocking rates.

Over the range of margins and nitrogen prices considered, Systems 1, 2, and 4 appear to represent the best strategies for growing calves on winter pasture. These systems were best under the most adverse conditions (negative margin and moderate and high nitrogen prices), and were either best or near best for the zero-and positive-margin comparisons.

Of these three systems, System 1 appeared best when the margin was negative and poorest when the margin was positive. At the highest nitrogen price, System 2 always ranked before System 4 although the difference in net returns was not significant for any of the three margins.

In terms of negative results, System 9 ranked last in 8 situations and next to last in the other. Within a nitrogen level, the system where all animals were removed and fed in drylot always gave the lowest net returns.

Our results indicate that recommendations to produce should emphasize a winter grazi strategy best adapted to a range possible combinations of nitrog prices and margins. Nitrog prices of 18 cents per pound above are most likely, and negati margins are the general rule. T favored systems under these co ditions are 1, 2, and 4, and the systems would not serious penalize the producer und favorable margins or lowe nitrogen prices.

Table 11. Net returns per acre at different cattle price levels, nine winter grazing systems, MAFES Brown Loam Branch Station, 1970-74.[1]

Sys-	N	Buying price = $33.08/cwt.			Buying price = $38.08/cwt.			Buying price = $43.08/cwt.		
		Selling price			Selling price			Selling price		
tem	Level	29.96	33.08	36.20	34.96	38.08	41.20	39.96	43.08	46.20
1	148	$19.69	$52.95	$86.20	$43.14	$76.40	$109.65	$66.59	$99.85	$133.10
2	148	5.26	46.54	87.82	31.79	73.07	114.35	58.34	99.62	140.90
3	148	-8.81	31.87	72.60	16.86	57.57	98.28	42.53	83.23	123.94
4	229	6.06	48.96	91.86	34.95	77.85	120.75	63.84	106.74	149.64
5	229	-18.17	32.11	82.40	12.92	63.21	113.49	44.00	94.28	144.57
6	229	-20.23	30.31	80.85	11.22	61.76	112.30	42.65	93.19	143.73
7	331	-25.61	25.85	77.32	7.00	58.46	109.92	39.59	91.05	142.52
8	331	-28.12	32.56	93.24	9.56	70.24	130.92	47.22	107.90	168.58
9	331	-60.53	-2.15	56.23	-26.53	31.84	90.22	7.46	65.84	124.22

[1] Nitrogen price = $.18/lb.

Bulletin 866

April 1978

Sequential and Tank Mix Combinations of Selected Herbicides for Control of Prickly Sida and Seedling Johnsongrass in Cotton

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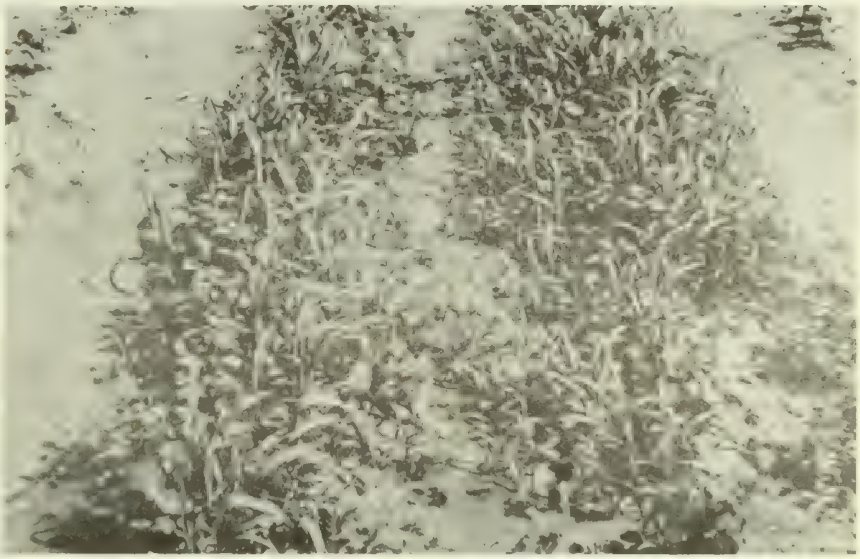
Sequential and Tank Mix Combinations of Selected Herbicides for Control of Prickly Sida and Seedling Johnsongrass in Cotton

Sequential applications of everal herbicides (application replant incorporated followed by reemergence application) are now egistered for control of weeds in otton. However, cotton producers ften want to apply herbicides as ank mixes (two herbicides mixed n the same tank and applied replant incorporated) to reduce xpense and conserve time by liminating a trip over their fields. Therefore, we investigated the easibility of tank mixes of selected erbicides for control of annual roadleaf weeds and grasses in otton.



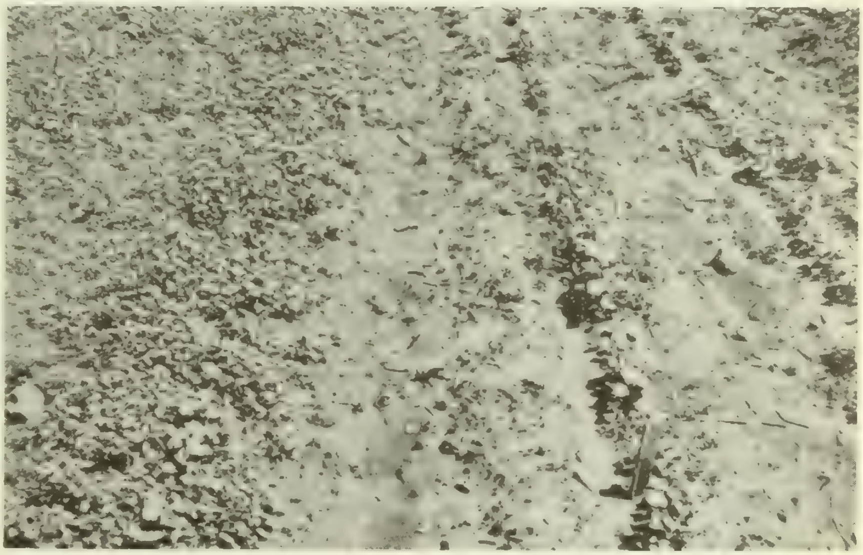
No herbicide (photographed 33 days after planting).

Materials and Methods

A 3-year experiment was conducted on a loam soil in Bolivar County, Mississippi. The soil used in 1974 and 1976 had a pH of 6.5 and was composed of sand (50%), silt (40%), clay (10%) and organic matter (0.84%). The soil used in 1975 had a pH of 6.75 and was composed of sand (41%), silt (44%), clay (15%) and organic matter (1.37%).

The experimental design was a randomized complete block with three replications. Each plot was two 40-inch rows 50 feet long.

All plots were fertilized at the rate recommended for optimum production and seedbeds were prepared. We applied individual herbicides and tank mix combinations immediately after



No herbicide (left), 0.75 lb/A trifluralin plus 1.5 lb/A fluometuron tank mix, preplant incorporated (photographed 33 days after treatment).

preparing seedbeds and incorporated them on a 16-inch band---using one pass of a double-gang rolling cultivator. A weedy check and plots for evaluating the effectiveness of preemergence herbicides alone were not treated preplant.

'DPL-16' cottonseed (*Gossypium hirsutum* L.) were planted on all plots immediately after completing soil incorporation of the preplant herbicides. Seed at the rate of 30 lb/A were planted 1 inch deep in moist soil on April 30, 1974; May 23, 1975 and April 20, 1976. Preemergence herbicides were surface applied within one day after planting. Plots other than the weedy check and those treated preplant were treated preemergence. The 1975 and 1976 trials included preplant applications of single herbicides without follow-up preemergence treatment.

All herbicides were appli
broadcast in a spray volume at t
rate of 20 gallons per acre in 19
and 1975, 28.5 gallons in 197
Herbicides used are listed in Tab
1. A tractor sprayer was used
1974, a two-wheel bicycle push-ty
compressed air sprayer in 1975 a
a backpack CO_2 sprayer in 197

A rain gauge about 1 mile fro
the test site recorded rainfall for
days after planting as follows:

1974	1975	1976
(inches)	(inches)	(inches)
May 1 - 0.6	May 26 - 0.75	April 21 - 0.4
May 5 - 0.2	May 28, 29 - 1.3	April 24 - 1.8
May 11 - 1.6	June 10-12 - 1.4	April 30 - 0.2
May 14 - 1.4	June 15 - 0.5	May 6 - 0.15
May 21, 22 - 1.5		May 14 - 0.25
May 26 - 0.75		May 15 - 0.6
		May 16 - 0.3

1 lb/A profluralin plus 1.5 lb/A fluometuron tank mix, preplant incorporated (photographed 33 days after treatment).

Table 1. Herbicides---trade name, common name and chemical formula, broadcast rate (lb/A ai) and years in the experiment, Bolivar county, Miss., 1974-1976.

Trade name[1]	Common name	Chemical formula	Broadcast rate	Years in Experiment
			lb/A ai	
Amex®	butralin[1]	4-(1,1-dimethylethyl)-**N**-(1-methylpropyl)-2,6-dinitrobenzenamine	2.0	1974, 1975, 1976
Basalin®	fluchloralin	**N**-(2-chloroethyl)-2,6-dinitro-**N**-propyl-4-(trifluoromethyl)aniline	0.75	1974, 1975, 1976
Cobex®	dinitramine	N_4,N_4-diethyl-*a,a,a*-trifluoro-3,5-dinitrotoluene-2,4-diamine	0.5	1974, 1975, 1976
Cotoran®	fluometuron	1,1-dimethyl-3-(*a,a,a*-trifluoro-**m**-tolyl)urea	1.5	1974, 1975, 1976
HOE 2991	tetrafluron	**N,N**-dimethyl-N_1-[3-(1,1,2 2-tetrafluoroethoxy)phenyl] urea	1.2	1976
Karmex®	diuron	3-(3,4-dichlorophenyl)-1,1-dimethylurea	1.0	1976
Planavin®	nitralin	4-(methylsulfonyl)-2,6-dinitro-**N,N**-dipropylaniline	0.75	1974
Prowl®	pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine	0.75	1975, 1976
Tolban®	profluralin	**N**-(cyclopropylmethyl)-*a,a,a*-trifluoro-2,6-dinitro-**N**-propyl-**p**-toluidine	0.75	1974, 1975, 1976
Treflan®	trifluralin	*a,a,a*-trifluoro-2,6-dinitro-**N,N**-dipropyl-**p**-toluidine	0.75	1974, 1975, 1976
Zorial®	norflurazon	4-chloro-5-(methylamino)-2-(*a,a,a*-trifluoro-**m**-tolyl)-3(2**H**)-pyridazinone	1.5	1974, 1975, 1976

Trade names are given solely for purposes of identification. Mention or omission of any trade name implies neither endorsement nor criticism by the Mississippi Agricultural and Forestry Experiment Station.

[1] Applied 2.25 lb in 1974.

Cotton stands were determined by counting plants on 50 feet of one row in each plot. Weed counts were made on one preselected row in each plot. Three 1-square-foot quadrants per row were used in 1974, two 1-square-foot quadrants in 1975, and two 1-foot-by-3-feet quadrants (narrow axis centered over row) in 1976. Visual evaluations of crop injury and control of broadleaf and grass weeds (0 = no control, 100 = complete control) were made three or four weeks after crop emergence. Plots were not cultivated before plant counts and visual evaluations were made.

All data were converted to percentages and transferred to arc sin for subjecting to analysis of variance. Means were separated by Duncan's New Multiple Range Test.

Results and Discussion

Cotton emerged to a good stand each year and symptoms of herbicide injury were not observed. Low temperatures reduced overall height of cotton plants in 1976 but all treatments were affected uniformly.

Natural populations of prickly sida were high in 1974 and 1976. Large infestations of seedling johnsongrass[1] occurred each year. Scattered annual morningglory (*Ipomoea* spp. L.), common cocklebur (*Xanthium pensylvanicum* Wallr.), spotted spurge (*Euphorbia maculata* L.), hophornbeam copperleaf (*Acalypha ostryaefolia* Riddell) and large crabgrass (*Digitaria sanguinalis* (L) Scop.) were observed.

Annual Broadleaf Weeds---Control with each combination of herbicides was slightly better when applied sequentially than when applied tank mixed; however, differences were significant ($P < .05$) only for fluchloralin and fluometuron in 1974, fluchloralin and norflurazon in 1976 (Table 2).

All herbicides applied preplant alone in 1975 provided poor control. Control with herbicides applied preplant alone in 1976 was generally poorer than control with these herbicides applied as sequential or tank mix combinations, but only a few differences were significant.

Prickly Sida---Sequential applications gave generally higher control values than tank mix combinations in 1974 but differences were not significant (Table 3). Control with all treatments was generally below acceptable levels. Sequential applications in 1976 also gave generally better control than did tank mix combinations; however differences were significant ($P < .05$) only for trifluralin and fluometuron.

Control with butralin, pendimethalin, profluralin and trifluralin applied preplant alone in 1976 did not differ significantly from control with these herbicides applied as sequential or tank mix combinations. Butralin and pendimethalin were more effective

Table 2. Control of annual broadleaf weeds with selected herbicides applied preplant incorporated alone, applied preplant incorporated as tank mix combinations (TM), applied as preplant incorporated and surface preemergence sequential combinations (S), and applied preemergence alone; Bolivar County, MS, 1974-1976[1].

Treatment		Year[2]											
		1974				1975				1976			
Preplant	Preemergence	Pre-plant	TM	S	Pre-emergence	Pre-plant	TM	S	Pre-emergence	Pre-plant	TM	S	Pre-emergence
		Percent Control											
Butralin	Fluometuron	---	95ab	98a	97a	0k	62a-g	93a	73a-d	73a-e	90a-c	94a	82a-d
Butralin	Norflurazon		97a	98a	98a		40c-i	58a-h	68a-f		91a-c	88a-c	90a-c
Butralin	Diuron		---	---	---		---	---	---		53d-g	77a-e	33fg
Dinitramine	Fluometuron	---	94ab	97a		32g-j	48b-h	90ab		75a-e	89a-c	93ab	
Dinitramine	Norflurazon		98a	97a			53b-h	52b-h			90a-c	92a-c	
Fluchloralin	Fluometuron	---	89b	98a		13i-k	72a-e	82a-c		65a-f	88a-c	87a-d	
Fluchloralin	Norflurazon		93ab	98a			30e-j	58a-h			50e-g	85a-d	
Nitralin	Fluometuron	---	97a	98a		---	---	---		---	---	---	
Nitralin	Norflurazon		91ab	97a			---	---			---	---	
Pendimethalin	Fluometuron	---	---	---		20h-k	70a-f	87ab		82a-d	90a-c	94a	
Pendimethalin	Norflurazon		---	---			27e-j	68a-f			85a-d	85a-d	
Profluralin	Fluometuron	---	93ab	98a		7jk	65a-f	88ab		62c-f	91a-c	92ab	
Profluralin	Norflurazon		96ab	92ab			33f-j	50b-h			90a-c	85a-d	
Trifluralin	Fluometuron	---	94ab	98a		0k	57a-h	82a-c		63b-f	78a-d	92a-c	
Trifluralin	Norflurazon		97a	98a			37d-i	53b-h			93a-c	72a-e	
---	Tetrafluron		---	---	---		---	---	---		---	----	85a-d
Weedy check			-------0c------				-------0k-------				-------0g-------		

[1]Control based on visual estimations.

[2]Values within years followed by a common letter are not different ($P = .05$) according to Duncan's New Multiple Range Test.

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[1] *Seedling johnsongrass plants were differentiated from rhizome plants on the basis of plant height.*

Table 3. Control of prickly sida with selected herbicides applied preplant incorporated alone, applied preplant incorporated as tank mix combinations (TM), applied as preplant incorporated and surface preemergence sequential combinations (S), and applied preemergence alone; Bolivar County, MS, 1974 and 1976.

Treatment		Year							
		1974[1]				1976[2]			
Preplant	Preemergence	Pre plant	TM	S	Pre-emergence	Pre-plant	TM	S	Pre-emergence
		Percent Control							
Butralin	Fluometuron	---	39	47	30	86a-c	87a-e	99a	87a-e
Butralin	Norflurazon		46	68	44		84a-e	95a-c	80a-e
Butralin	Diuron		---	---	---		70a-e	85a-e	23fg
Dinitramine	Fluometuron	---	20	35		54d-f	81a-e	92a-c	
Dinitramine	Norflurazon		50	67			91a-e	96a-c	
Fluchloralin	Fluometuron	---	40	66		52ef	90a-e	94a-c	
Fluchloralin	Norflurazon		46	81			64b-f	84a-e	
Nitralin	Fluometuron	---	49	52		---	---	---	
Nitralin	Norflurazon		37	62			---	---	
Pendimethalin	Fluometuron	---	---	---		82a-e	78a-e	94a-c	
Pendimethalin	Norflurazon		---	---			91a-e	95a-c	
Profluralin	Fluometuron	---	45	58		65a-e	95a-c	90a-c	
Profluralin	Norflurazon		81	64			85a-e	92a-c	
Trifluralin	Fluometuron	---	32	50		67a-e	62c-f	98ab	
Trifluralin	Norflurazon		41	70			83a-e	86a-e	
---	Tetrafluron		---	---	---		---	---	95a-c
Weedy check[3]									

[1] **No differences (P = .05).**

[2] **Values within years followed by a common letter are not different (P = .05) according to Duncan's New Multiple Range Test.**

[3] **Plants per square foot were 15.7 in 1974, 17.7 in 1976. Data for 1975 is not presented because weeds were not sufficient to be meaningful. (Control in all plots based on actual counts.)**

than other herbicides applied preplant alone.

Fluometuron and norflurazon applied preemergence alone in 1974 provided poor control. Control with fluometuron, norflurazon and tetrafluron applied preemergence alone in 1976 compared favorably with that provided by sequential and tank mix combinations. Diuron applied preemergence alone in 1976 gave very poor control.

Annual Grass Weeds---All combinations other than profluralin and norflurazon in 1975, dinitramine and fluometuron in 1976 and pendimethalin and fluometuron in 1976 gave better control when applied sequentially than when applied as tank mixes (Table 4). However, differences were significant only for butralin and norflurazon in 1974, nitralin and norflurazon in 1974.

Control with butralin, dinitramine, fluchloralin and trifluralin applied preplant alone in 1975 compared favorably with that provided by all sequential combinations. Results with pendimethalin and profluralin did not differ (P<.05) from those obtained with any sequential or tank mix combination. All herbicides applied preplant incorporated in 1976 were as effective as any sequential or tank mix combination.

Fluometuron and norflurazon applied preemergence alone were as effective as any combination used in 1974, were generally less effective than sequential combinations in 1975, and were equally or more effective than tank mix combinations in 1976. Control with all herbicides applied preemergence alone in 1976 did not differ (P<.05) from control with sequential or tank mix combinations.

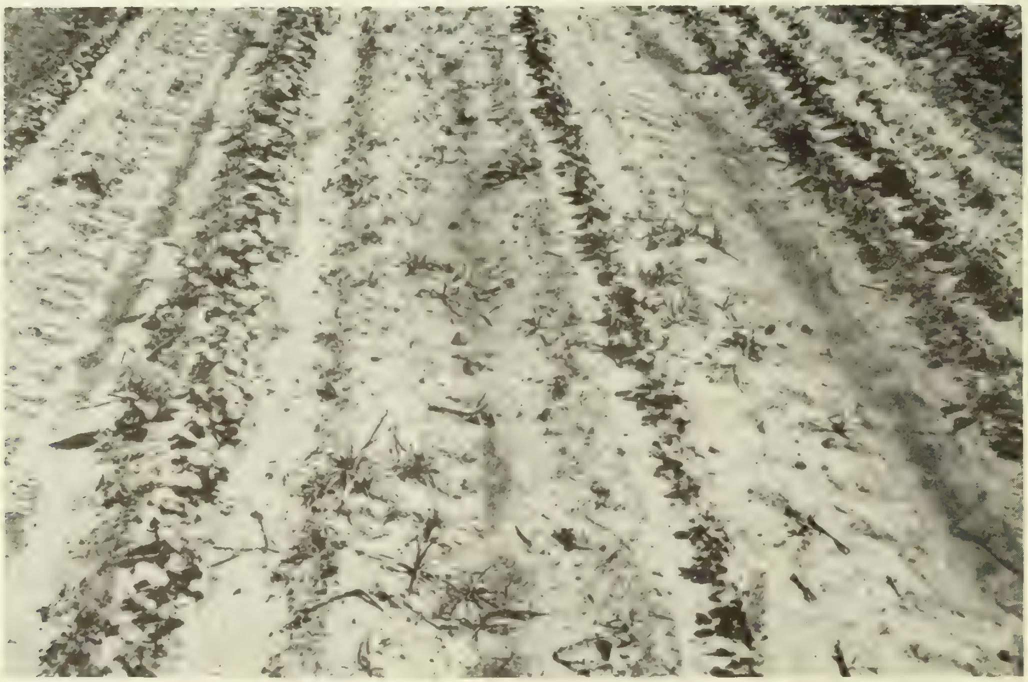
Seedling Johnsongrass---Differences in control attained with sequential and tank mix combinations in 1974 and 1975 were not significant (P<.05).

Table 4. Control of annual grass weeds with selected herbicides applied preplant incorporated alone, applied preplant incorporated as tank mix combinations (TM), applied as preplant incorporated and surface preemergence sequential combinations (S), and applied preemergence alone; Bolivar County, MS, 1974-1976[1].

Treatment		Year[2]											
		1974				1975				1976			
Preplant	Preemergence	Preplant	TM	S	Preemergence	Preplant	TM	S	Preemergence	Preplant	TM	S	Preemergence
		Percent Control											
Butralin	Fluometuron	---	95ab	98a	97a	68a-d	73a-d	88a	52c-e	82a	80a	84a	93a
Butralin	Norflurazon		90bc	98a	97a		43de	68a-d	70a-d		82a	90a	87a
Butralin	Diuron		---	---	---		---	---	---		66ab	91a	73ab
Dinitramine	Fluometuron	---	97a	98a		67a-d	64a-d	88a		90a	91a	91a	
Dinitramine	Norflurazon		93a-c	97a			66a-d	78a-c			87a	90a	
Fluchloralin	Fluometuron	---	95ab	98a		72a-d	63a-d	80a-c		88a	86a	89a	
Fluchloralin	Norflurazon		90bc	98a			72a-d	80a-c			57b	90a	
Nitralin	Fluometuron	---	94ab	98a		---	---	---		---	---	---	
Nitralin	Norflurazon		88c	97a			---	---			---	---	
Pendimethalin	Fluometuron	---	---	---		40de	67a-d	82a-c		77ab	90a	90a	
Pendimethalin	Norflurazon		---	---			72a-d	88a			87a	87a	
Profluralin	Fluometuron	---	95ab	98a		30de	60a-d	78a-c		87a	91a	93a	
Profluralin	Norflurazon		93a-c	97a			62a-d	60a-d			83a	93a	
Trifluralin	Fluometuron	---	94ab	98a		60a-d	60a-d	87ab		68ab	92a	93a	
Trifluralin	Norflurazon		94ab	98a			57b-d	72a-d			88a	87a	
---	Tetrafluron		---	---	---		---	---	---		---	---	83a
Weedy check			0d				0f				6c		

[1] Control based on visual estimates.

[2] Values within years followed by a common letter are not different (P = .05) according to Duncan's New Multiple Range Test.



1.5 lb/A norflurazon (left) and 1.5 lb/A fluometuron (right), both applied preemergence (photographed 33 days after treatment).

Butralin and diuron provided excellent control when applied sequentially in 1976, poor control when applied as a tank mix. Control with other sequential and tank mix combinations used in 1976 did not differ.

All herbicides applied preplant alone gave poor control in 1975. Results with herbicides applied preplant alone in 1976 did not differ significantly from results with sequential and tank mix combinations.

Norflurazon applied preemergence alone in 1974 gave good to excellent control. Fluometuron and norflurazon applied preemergence in 1975 and tetrafluron applied preemergence in 1976 gave poor control. Control with flurometuron, norflurazon and diuron applied preemergence in 1976 did not differ significantly from that with sequential and tank mix combinations.

Table 5. Control of seedling johnsongrass with selected herbicides applied preplant incorporated alone, applied preplant incorporated as tank mix combinations (TM), applied as preplant incorporated and surface preemergence sequential combinations (S), and applied preemergence alone; Bolivar County, MS, 1974-1976.

Treatment		Year[1]											
		1974				1975				1976			
Preplant	Preemergence	Preplant	TM	S	Preemergence	Preplant	TM	S	Preemergence	Preplant	TM	S	Preemergence
		Percent Control											
Butralin	Fluometuron	---	89a	87a	76ab	13d-f	70a-e	91a	15c-f	84a-c	72a-d	54b-d	92a-c
Butralin	Norflurazon		71ab	95a	86a		31a-f	52a-f	50a-f		62a-d	94a-c	80a-d
Butralin	Diuron		---	---	---		---	---	---		33de	96ab	81a-d
Dinitramine	Fluometuron	---	77ab	83ab		61a-e	81a-d	88ab		58a-d	88a-c	96ab	
Dinitramine	Norflurazon		82ab	90a			80a-d	87a-c			66a-d	89a-c	
Fluchloralin	Fluometuron	---	91a	85a		56a-f	49a-f	33a-f		79a-d	86a-c	78a-c	
Fluchloralin	Norflurazon		80ab	93a			64a-e	62a-e			73a-d	99a	
Nitralin	Fluometuron	---	84a	60ab		---	---	---		---	---	---	
Nitralin	Norflurazon		54b	74ab			---	---			---	---	
Pendimethalin	Fluometuron		---	---		38a-f	13d-f	65a-e		67a-d	77a-d	88a-c	
Pendimethalin	Norflurazon		---	---			44a-f	67a-e			86a-c	73a-d	
Profluralin	Fluometuron		90a	89a		37a-f	29b-f	54a-f		76a-d	81a-d	88a-c	
Profluralin	Norflurazon		84a	89a			71a-e	60a-e			83a-d	94ab	
Trifluralin	Fluometuron	---	85a	89a		31a-f	19c-f	63a-e		58a-d	79a-d	90a-c	
Trifluralin	Norflurazon		89a	85a			49a-f	68a-e			83a-d	93a-c	
---	Tetrafluron		---	---	---		---	---	---		---	---	47cd
Weedy check[2]													

[1] Values within years followed by a common letter are not different (P = .05) according to Duncan's New Multiple Range Test.

[2] Plants per square foot were 20.8 in 1974; 6.7 in 1975; 6.9 in 1976. (Control in all plots based on actual counts.)

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April 1978

Mississippi Grain Sorghum Performance Trials in 1977

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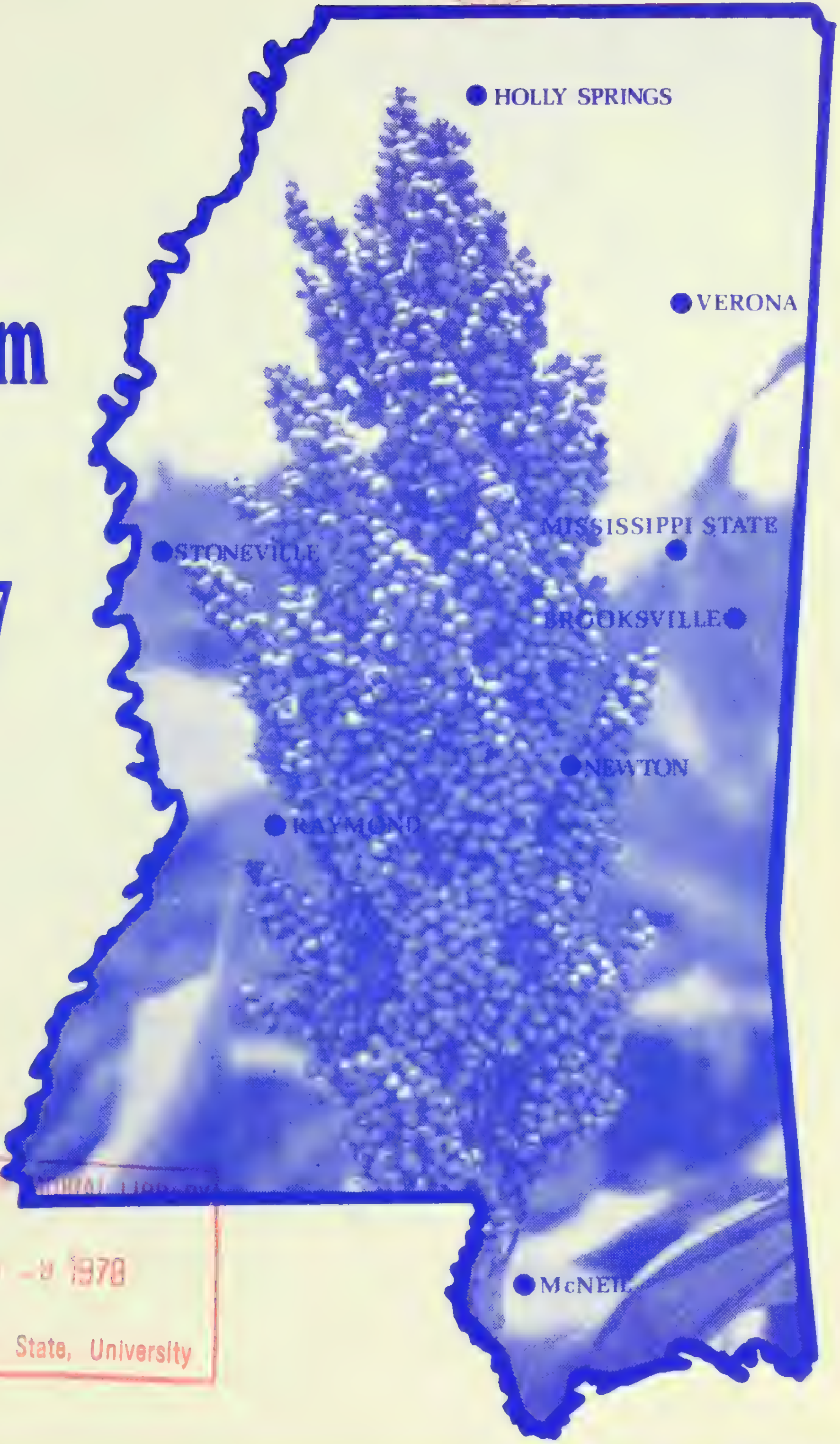
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Bulletin 867

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Mississippi Grain Sorghum Performance Trials in 1977

Trials are conducted annually in Mississippi to provide farmers, seedsmen, county agents, and other interested persons with information on performance of commercially-available grain sorghum hybrids. Results are particularly helpful to grain sorghum producers in selecting hybrids suited to their area.

We tested 44 commercial and experimental hybrids at seven locations in Mississippi in 1977 (Table 1). Because a true test of performance cannot be made without control of insects, insecticides were applied as needed (two applications of a recommended insecticide usually are sufficient).[1]

Resistance to diseases is important in selecting a hybrid for areas where diseases are a problem. Also, planting at the recommended time will reduce damage caused by diseases and insects.

Quantity of harvested good-quality grain (or silage) is the best guide to the desirability of sorghum hybrids. Performance data for any one year may be misleading. Therefore, performance of each hybrid tested in 1977 is presented in this report along with two-and three-year averages of performance of hybrids that have been tested for this long.

Table 1. Planting dates, fertilizer rates, and insecticides applied, Hybrid Grain Sorghum Performance Trials, by location of trials, Mississippi, 1977.

Location	Planting date	Fertilizer rates[1]	Insecticides applied[2]
McNeil[3]	May 9	13-13-13 PP 68-0-0 SD	3-diazinon
Raymond	May 31	65-65-65 PP 100-0-0 SD	None
Newton	May 18	65-65-65 PP 72-0-0 SD	None
Mississippi State[4]	April 28	52-52-52 PP 125-0-0 SD	3-diazinon
Stoneville[5]	June 20	120-0-0 PP	2-sevin
Verona[6]	April 28	168-0-0 SD	None
Holly Springs	May 12	60-60-60 PP	1-sevin

[1] SD = Sidedressed, PP = Preplant.
[2] Insecticides applied as labeled.
[3] Irrigated twice (approx. ¾ ″ water/irrigation).
[4] Irrigated three times (furrow irrigation).
[5] Irrigated once (furrow irrigation).
[6] Split nitrogen application - 68# 5/6/77, 100# 6/1/77.

Testing Procedures

A randomized complete block experimental design with four replications was used at all locations. Each plot consisted of two rows 36, 38 or 40 inches wide and 20 feet long. All trials were planted at the rate of seven pounds of seed per acre. Areas of 1/1000 of an acre were hand-harvested from each replication, heads were dried and threshed, and grain yield was adjusted to 14% moisture. The total plot of each replication was combine harvested at the Stoneville location. Trials with average bir damage of more than 25% were no harvested. Data reported have no been adjusted for bird damage Planting dates, fertilizer rates an insecticides applied are presente in Table 1.

---

[1] *See MAFES Bulletins 817 and 836 for methods of control of grain sorghum insects.*

Results

Hybrids were separated into two trials at each location, 30 non-bird-resistant hybrids in one trial (Table 2) and 14 bird-resistant hybrids in the other (Table 3). Bird damage was negligible at all locations except Mississippi State and Verona. This probably was due to the early planting date at these two locations. Bird damage to the non-bird-resistant hybrids ranged from 6 to 31% at Mississippi State, from 3 to 48% at Verona. Bird damage at both locations averaged 12%.

Lodging was significant only at Verona where it ranged from 0 to 28% and averaged 8%. The tests at Stoneville were planted near fields of cotton and sustained methyl-parathion burn due to drift from aerial spraying. Damage ratings are reported in Tables 2 and 3.

Grain yield of the 30 non-bird-resistant hybrids in the 1977 trials ranged from 1911 pounds per acre for Warner W-866 in the Stoneville trials to 5725 for Funk's G522DR in the Verona trials. Yield of the 30 hybrids averaged 3577 pounds per acre for the seven test locations (Table 2).

Grain yield of the 14 bird-resistant hybrids in the 1977 trials ranged from 1862 pounds per acre for N.K. Savanna 3 in the Stoneville trial to 6398 for Pioneer brand B815 in the Verona trial. Yield of the 14 hybrids averaged 3780 pounds per acre for the seven test locations (Table 3). Yields of all hybrids in the southern ¾ of the state were reduced due to prolonged drought.

Three-year average yields of non-bird-resistant and bird-resistant hybrids are reported in Tables 4 and 5, respectively. Two-year average yields of both classes of hybrids are reported in Tables 6 and 7, respectively.

Table 2. Performance of 30 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, average of seven locations (McNeil, Raymond, Newton, Mississippi State, Stoneville, Verona and Holly Springs), 1977.

							Yield							
Hybrid	50% Bloom[1]	Plant height[2]	Methyl-Para-thion rating[3]	Bird damage[4]	Lodg.[5]	Test weight[6]	McNeil	Raymond	Newton	Miss. State	Stone-ville	Verona	Holly Springs	Mean
	(days)	(in.)	(1-5)	(%)	(%)	(lbs/bu)	(lbs/A)							
ACCO R 1090	62	47	.5	7	6	57.5	2895	3919	2820	4896	5088	5387	5332	4334
Funk's G522DR	63	49	2.2	9	4	57.9	3364	3860	2832	4828	4451	5725	3724	4112
McNair 650	61	45	1.8	8	4	59.0	3991	3706	2932	5008	4189	5324	2508	3951
Funk's G522	64	45	2.0	8	5	58.6	3096	3692	2669	4771	3986	4858	4384	3922
GSA ML-135	62	46	1.5	6	4	57.1	3537	3794	2637	4817	4002	3853	4723	3909
ACCO R 109-A	62	44	1.8	8	4	55.5	3191	3794	2279	4608	4500	4442	4529	3906
Wilstar 1425	66	48	2.5	8	9	55.9	2733	3945	2752	4676	3855	5022	4268	3893
Funk's G662	64	47	3.0	8	3	58.6	2543	3420	2730	5554	3920	5372	3419	3851
ACCO R 1029-A	61	48	0	12	8	56.4	3399	3492	2659	4134	4369	4133	4727	3845
Warner W-839DR	64	47	1.8	7	2	59.0	4144	3664	2552	4869	3929	4201	3176	3791
Pioneer brand 8311	66	46	4.2	7	2	60.0	3213	3459	2479	3960	3790	4802	4412	3731
Wilstar 1225	63	45	1.5	6	2	58.5	2414	3497	2557	4352	4238	4966	4051	3725
Trojan M56G	62	46	2.8	10	4	58.2	2824	3554	2428	4151	3512	4554	4782	3686
Funk's G622 GBR	63	46	3.0	10	4	57.1	2809	3734	2893	3982	3675	4491	4150	3676
Pioneer brand 8272	63	47	2.8	8	4	58.0	2643	3730	2438	4026	3218	4656	4890	3657
T.T. Two 62yG	64	45	1.8	4	0	56.4	2392	2709	2830	4461	3667	4939	3844	3549
T-E Y101-R	63	45	2.5	10	5	55.9	3090	3323	2774	4205	3512	4274	3753	3562
Trojan M59	65	48	4.5	11	21	56.2	3021	3451	2343	3900	3169	4021	4303	3458
N.K. brand 2779	62	45	2.2	9	1	58.4	2392	3233	2335	4216	3813	4739	3320	3435
R.A. 808Gb	64	47	3.8	8	3	51.8	2651	3620	2888	4300	2817	3974	3717	3424
ACCO DR1085	63	47	2.8	10	2	58.9	2902	3176	2871	4725	2956	4021	3139	3399
DeKalb C-42y+	61	52	1.2	20	14	55.2	3148	4060	2555	3683	3594	3210	3546	3399
N.K. brand 2778	63	48	2.2	13	23	58.0	2722	2993	2633	4736	3259	3938	3185	3352
Funk's G642 GBR	66	49	3.2	11	18	55.4	2578	3431	2426	4608	2524	4274	3482	3332
Wilstar 1330	63	52	2.5	20	18	56.6	2759	4165	2538	4390	3332	2798	3149	3304
Warner W-832	63	46	5.0	16	2	56.9	2658	3462	3000	2598	2213	3465	5062	3208
Pioneer brand 8225	65	52	4.5	30	24	58.5	2755	3433	3142	2502	2614	2944	4610	3143
Warner W-866	62	50	5.0	26	28	58.4	2837	3521	2767	2105	1911	3741	4484	3052
DeKalb E-57b+	64	50	2.8	15	19	56.4	2707	2921	2679	4197	2924	3322	2400	3021
Funk's G-399	61	43	1.2	36	4	55.4	2038	2786	2669	2981	2777	2070	3347	2667
Mean	63	47	2.6	12	8	57.2	2919	3519	2669	4208	3527	4250	3947	3577
L.S.D. (.05)							974	961	777	647	956	1054	1427	---
C.V.							20.9%	19.7%	21.0%	11.1%	19.6%	17.9%	26.1%	---

[1] Recorded at Raymond, Newton, Mississippi State, Stoneville, Verona, and Holly Springs, MS.
[2] Recorded at all locations.
[3] Recorded at Stoneville, MS. 1 = little or no leaf burn, 5 = most leaves with large burned areas.
[4] Recorded at Mississippi State and Verona, MS.
[5] Recorded at Verona, MS.
[6] Recorded at Newton, Mississippi State, and Verona, MS.

Table 3. Performance of 14 bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, average of seven locations (McNeil, Raymond, Newton, Mississippi State, Stoneville, Verona and Holly Springs), 1977.

Hybrid	50% Bloom[1]	Plant height[2]	Methyl-Parathion rating[3]	Lodg.[4]	Test weight[5]	McNeil	Raymond	Newton	Miss. State	Stoneville	Verona	Holly Springs	Mean
	(days)	(in.)	(1-5)	(%)	(lbs/bu)	----------	----------	----------	(lbs/A)	----------	----------	----------	
ACCO BR-Y93	62	48	.8	43	59.1	3824	2872	2060	5201	4565	5102	5368	4142
GSA 1334 BR	65	50	3.5	17	52.7	3347	3193	2974	5037	3520	5957	4800	4118
N.K. Savanna 5	64	60	5.0	28	59.7	4382	3809	3935	4363	2197	6290	3835	4116
Pioneer brand B815	64	57	4.5	35	54.7	3576	3088	3278	4156	3594	6398	4529	4088
Wilstar 1360-BR	64	49	3.5	20	54.3	3522	3327	2085	4619	3903	5048	4773	3897
Warner W-744	63	49	3.5	14	55.8	3388	3154	2730	4292	3218	5640	4755	3882
T-E Bird-A-Boo II	64	50	4.0	14	54.2	3518	3319	2406	5048	3234	4929	4583	3862
Funk's G516 BR	64	48	3.2	32	54.3	3671	2676	2793	5086	3512	4491	4385	3802
DeKalb BR-65+	65	53	2.0	3	56.4	3131	3376	2377	4164	3798	5840	3455	3734
DeKalb BR-64	65	55	3.6	22	56.5	3993	2122	3219	4967	3528	5993	2247	3724
DeKalb D-46	65	53	5.0	50	58.6	3619	2929	2574	4406	2547	4230	3672	3425
N.K. Savanna 3	62	49	5.0	11	50.9	3280	2698	3078	3571	1862	4983	4466	3420
T.T. Two 75BRG	64	49	4.3	17	55.9	2952	2366	2343	4404	2374	5652	3699	3399
R.A. Bird Go 68Gb	64	51	4.0	9	55.6	2668	3169	2036	4104	2614	5579	3004	3311
Mean	64	52	3.7	22	55.6	3490	3006	2706	4529	3197	5438	4112	3780
L.S.D. (.05)						678	1152	865	764	621	1398	1096	---
C.V.						14.0%	22.8%	23.0%	12.2%	14.0%	15.3%	19.2%	---

[1] **Recorded at Raymond, Newton, Mississippi State, Stoneville, Verona, and Holly Springs, MS.**

[2] **Recorded at all locations.**

[3] **Recorded at Stoneville, MS. 1 = little or no leaf burn, 5 = most leaves with large burned areas.**

[4] **Recorded at Verona, MS.**

[5] **Recorded at Newton, Mississippi State, and Verona, MS.**

Table 4. Yield of eight non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for three years, 1975-77.

Hybrid	Yield			
	McNeil	Raymond	Miss. State[1]	Mean
	---------	---------	lbs/A	---------
ACCO R 1090	3817	3789	3818	3808
Funk's G522	3935	3886	3579	3800
ACCO R 109-A	3672	3954	3758	3795
R.A. 808Gb	3866	3902	3568	3779
T-E Y101-R	3534	3654	3640	3609
ACCO R 1029-A	3872	3415	3501	3596
Warner W-832	3580	3690	2704	3325
Warner W-866	3613	3053	2472	3046
Mean	3736	3668	3380	3595

[1] Average for 1974, 1975, and 1977.

Table 5. Yield of six bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for three years, 1975-77.

Hybrid	Yield				
	McNeil	Raymond	Miss. State	Verona	Mean
	lbs/A				
N.K. Savanna 5	4349	4669	5208	5157	4846
ACCO BR-Y93	4273	4346	5399	4987	4751
Pioneer brand B815	4216	4386	4655	5152	5602
Funk's G516 BR	4269	3789	5297	4351	4426
DeKalb BR-64	4064	3663	5241	4727	4424
T-E Bird-A-Boo II	4020	4007	4919	4244	4298
Mean	4198	4143	5120	4770	4558

Table 6. Yield of 16 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for two years, 1976-77.

Hybrid	Yield		
	McNeil	Raymond	Mean
	lbs/A		
GSA ML-135	4750	4311	4530
Wilstar 1425	4654	4340	4497
Pioneer brand 8311	4484	4236	4360
Funk's G522	4393	4193	4293
R.A. 808Gb	4293	4132	4212
Funk's G622 GBR	4324	3974	4149
Wilstar 1225	4258	3984	4121
ACCO R 109-A	3940	4294	4117
ACCO R 1029-A	4453	3636	4044
Warner W-832	3900	4131	4016
ACCO R 1090	4134	3847	3990
ACCO DR1085	4419	3376	3898
T.T. Two 62yG	4204	3392	3798
T-E Y101-R	3912	3637	3774
Wilstar 1330	4394	3128	3761
Warner W-866	4121	3161	3641
Mean	4290	3860	4075

Table 7. Yield of ten bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for two years, 1976-77.

	Yield				
Hybrid	**McNeil**	**Raymond**	**Miss. State**	**Verona**	**Mean**
	------------------	------------------	lbs/A	------------------	------------------
GSA 1334 BR	5352	4206	6192	6327	5519
ACCO BR-Y93	5270	4148	6270	6279	5492
N.K. Savanna 5	5542	4592	5218	6532	5471
Pioneer brand B815	4866	4506	5346	6560	5320
Warner W-744 BR	4638	4126	6094	6148	5252
Wilstar 1360-BR	5030	4229	5988	5722	5242
Funk's G516 BR	5275	3885	6165	5582	5227
T-E Bird-A-Boo II	4934	4240	6004	5496	5168
DeKalb BR-64	5142	3306	5936	5929	5078
DeKalb BR-65+	4841	3898	5555	5980	5068
Mean	5089	4114	5876	6056	5284

Hybrids Designated for Entry in the 1977 Mississippi Grain Sorghum Performance Trials, by Sponsers.

Hybrid	Company	Address
ACCO R 109-A	ACCO Seed Company	Plainview, Texas
ACCO R 1090		
ACCO R 1029-A		
ACCO DR1085		
ACCO BR-Y93		
DeKalb C-42y+	DeKalb AgResearch, Inc.	Lubbock, Texas
DeKalb E-57B+		
DeKalb BR-64		
DeKalb BR-65+		
DeKalb D-46		
Funk's G399	Louisiana Seed Co., Inc.	Plainview, Texas
Funk's G522		
Funk's G516 BR		
Funk's G622 GBR		
Funk's G642 GBR		
Funk's G662		
Funk's G522DR		
Growers ML-135	Growers Seed Assn.	Lubbock, Texas
Growers GSA 1334 BR		
McNair 650	McNair Seed Co.	Laurinburg, North Carolina
N.K. Savanna 3	Northrup, King & Co.	Richardson, Texas
N.K. Savanna 5		
N.K. brand 2778		
N.K. brand 2779		
Pioneer brand B815	Pioneer Hi-Bred, Inc.	Tipton, Indiana
Pioneer brand 8311		
Pioneer brand B815		
Pioneer brand 8272		
Ring Around RA 808Gb	Ring Around Products, Inc.	Plainview, Texas
Ring Around RA Bird Go 68Gb		
T-E Bird-A-Boo II	Taylor-Evans Seed Co.	Tulia, Texas
T-E Y101-R		
Trojan M56G	Pfizer Genetics, Inc.	Elizabethtown, Kentucky
Trojan M59		
T.T. Two 75BRG	Texas Triumph Seed Co., Inc.	Ralls, Texas
T.T. Two 62yG		
Warner W-832	Warner Seed Co., Inc.	Hereford, Texas
Warner W-744 BR		
Warner W-866		
Warner W-839DR		
Wilstar 1225	Helena Chemical Co.	West Helena, Arkansas
Wilstar 1330		
Wilstar 1360-BR		
Wilstar 1425		

Bulletin 868

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Guidelines for Growing Alfalfa in Mississippi

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Mississippi State University

PREFACE

Scientists working independently and as interdisciplinary teams have studied alfalfa production technology for many years. Areas of specific interest have included plant characteristics, soil and fertilizer requirements, cultural practices, harvesting methods, pest control and plant breeding to develop varieties with improved tolerance to the disease and insect complexes associated with alfalfa production. This publication begins with the most current guidelines for producing alfalfa in Mississippi and concludes with a review of the research results on which the guidelines are based.

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Guidelines for Growing Alfalfa in Mississippi

Alfalfa (*Medicago sativa* L.) often is referred to as the "queen of forage crops" (Figure 1). It is a herbaceous perennial with leaves arranged alternately on stems. Plants produce distinct taproot systems that may penetrate 20 to 25 feet or deeper in porous soils and reach a height of 20 to 30 inches. Each plant may produce 5 to 25 shoots that arise from crown tissue after harvest or after maturity of older stems.

Feeding value of alfalfa is higher than that of the more commonly-grown hay and forage crops---per acre production of digestible protein exceeds that of clovers and is four times that of corn silage. Alfalfa also is a desirable component of rations for most farm animals because of its high mineral and vitamin content.

Alfalfa may be used for hay, silage or greenchop, with 2 to 5 tons of dry matter per acre harvested in 4 to 5 cuttings annually. It also is

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Figure 1. Harvesting a typical field of alfalfa.

an excellent pasture crop that will tolerate pasturing when grazed rotationally, but may sustain stand losses when grazed continuously. Also, poloxalene should be provided to prevent bloat of animals grazing pure stands.

The need for a reliable and relatively inexpensive source of protein for feeding livestock has stimulated interest in increasing the production of legumes for forage. Results of a recently-completed survey indicate that the 1.5 million acres of alfalfa currently grown in the Southern Region will increase to 3 to 4 million acres in the next five to ten years. Acreage increases are expected in 11 of the 13 southern states.

Alfalfa is adapted to a wide range of climates and soils and is drought resistant---plants become dormant in periods of drought stress and resume growth when soil moisture becomes favorable. It can be grown successfully in Mi sissippi if adapted varieties a planted on soils suitable for i production. Other keys t successful production are adequa fertilization (including lim proper inoculation with the corre strain of *Rhizobium* (nitroge fixing bacteria), and managing minimize damage by diseases an insects.

PRODUCTION GUIDELINES[1]

Soil Selection

Alfalfa grows best on soils with good drainage. Highest yields normally are attained on deep loam soils with porous subsoils. Silty and sandy soils also are suitable for alfalfa production, but the crop never should be planted on soils of this type with a history of Southern blight infestation. 'Delta' performs well on well-drained clay soils because of its tolerance to root and crown rots.

Fertilization

Soils should be tested for pH, phosphate and potash.[2] Lime should be applied before planting to bring the pH to 6.5 or above. Apply phosphate and potash to bring per acre levels of P_2O_5 and K_2O to 120-160 pounds of each in a 1 to 1 ratio, plus 1.5 pounds of boron. Materials should be incorporated 6 to 7 inches deep during seedbed preparation.

Maintenance requirements are liming to maintain soil pH at 6.5 or above and annual applications of 60-80 pounds P_2O_5 and 180-240 pounds K_2O in a 1 to 3 ratio, plus 1.5 pounds boron.

Seedbed Preparation

Ideal seedbeds are firm and moist to provide proper seed coverage and soil moisture adequate for germination. Fields should be cultipacked before and after planting. Cultipack before planting if soil is to be compacted only once.

Varieties

Delta, 'Cherokee', 'Arc,' 'Buffalo,' 'Cody' and 'Florida 66' are recommended for Mississippi (Table 1).

Delta has persisted in Mississippi tests longer and yields more than varieties from other areas. It also performs well on heavy clay soils because of its resistance to root and crown rots.

Cherokee has tolerance to leafhopper yellowing, alfalfa rust, crown and stem rots and certain leaf spots.

Arc carries resistance to southern anthracnose, several leaf spots, pea aphid and weevils.

Buffalo and Cody should be planted where bacterial wilt is a problem.

Florida 66 has extreme susceptibility to the spotted alfalfa aph in the area of seed production but type for resistance to this insect planned for release in the next tw years.

Inoculation

Inoculate seed with the prop strain of *Rhizobium* immediate before planting. Be sure to place th seed in direct contact with th inoculum. This normally is a complished by using a sugar-wat solution to stick the inoculum seed; however, commercial sticke are available. Applications molybdenum during the growi season may be beneficial, becau the *Rhizobium* require it for ma imum nitrogen fixation.

Planting

Seed may be broadcast, band or drilled. Banded or drilled se usually emerge faster and produ more growth the first year.

Planting Depth---A good rule thumb is to plant at a depth times the diameter of seed. Th depth prevents planting too de and permits sufficient contact seed with the soil.

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[1] *The guidelines presented in this bulletin incorporate the latest MAFES research results available at t time this publication was edited. Consult your area or county Cooperative Extension Service personnel determine whether more current guidelines are available.*

[2] *In the absence of a soil test, refer to the latest* **Crop and Fertilizer Guidelines for Mississippi.** *Yo county agent has these and they are available from MAFES Editorial Department, Mississippi State, MS 397*

Table 1. Average seasonal production of 19 alfalfa varieties grown in Mississippi (15 different experiments since 1961).

Variety	No. of years tested	Avg. D.M. yield Tons/Acre[1]	Variety	No. of years treated	Avg. D.M. yield Tons/Acre
Delta	12	6.10	Cayuga	6	4.10
Cody	12	5.85	Rhizoma	4	4.31
Cherokee	12	5.36	Vernal	6	4.45
Buffalo	12	5.64	Ranger	6	5.60
Florida 66	5	6.00	Lahontan	6	4.60
DuPuits	8	5.85	Uinata	4	4.40
Kansas Common	12	5.70	Flandria	4	3.25
Williamsburg	6	5.20	Caliverde	4	4.41
Culver	6	5.62	Moapa	4	4.59
Narragansett	6	5.05			

[1]Numbers of harvests varied from 4 to 6 per season, with first harvest about May 10.

Planting Rate---15 to 20 pounds f seed per acre are recommended. lanting 20 pounds of seed normal- insures a sufficient stand.

Planting Date---Seeding may egin as early as August 25 and hould not extend past October 15. pring seeding can be successful if reemergence herbicides are used.

eed Control[3]

Chemicals are the major means f controlling weeds and grasses in lfalfa. Herbicides normally are ot required for alfalfa seeded etween August 25 and October 15. owever, herbicides are available hat can be applied before planting preplant) or after alfalfa has merged (postemergence).

Preplant---Apply benefin Balan®) to control most annual rasses and broadleaf weeds. The aterial should be applied within ree weeks of planting but may be pplied immediately before eding if incorporated to a depth 3 inches.

Postemergence---Apply dinoseb newly-emerged alfalfa seedlings for control of some weeds (e.g., small chickweed). Treatment may be repeated if necessary. Established stands of alfalfa also may be treated.

Apply 2,4-DB for control of many small broadleaf weeds when alfalfa seedlings reach the two-to-four-trifoliate leaf stage. Vetch, chickweed and pennycress are not controlled. Grazing and harvesting are not permitted for 60 days after application.

Apply chlorpropham (Chloro IPC®) to control germinating annual weeds and some very small weed seedlings when alfalfa is actively growing, semi-dormant or dormant. Application should not be made before November 1. This material also can be used to reduce growth of dodder, but should be applied only to wet soils that are free of litter and clods. Timing is critical and application should be made when dodder begins to germinate but before it becomes attached to alfalfa plants. Do not apply the granular formulation if alfalfa foliage is wet.

Apply pronamide (Kerb®) both preemerge and postemerge for control of grasses and many small annual broadleaf weeds. It can be applied in fall and winter to newly-established and older alfalfa stands, but should not be applied before alfalfa plants reach the first trifoliate leaf stage. Grazing and removing forage for feeding livestock are not permitted within 120 days after application of the material.

Insect Control

Planting resistant varieties and modifying cultural practices are the first lines of defense against insect damage to alfalfa. For example, much of the leaf damage that otherwise would be attributed to insects can be avoided by making the first cutting early. The alfalfa weevil was a formidable foe three decades ago and still is considered capable of reaching population levels high enough to cause economic loss to the crop.[4] However, one timely application of an effective insecticide in the spring can be sufficient for control. Other insects generally do not require insecticide control in Mississippi.[5]

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[3] *Herbicide labels change frequently and new restrictions are imposed. The recommendations given in this ublication were current at the time this publication was edited. Consult your area or county Cooperative xtension Service personnel for material recommendations, rates and time of application.*

[4] *Pitre, H. N., B. C. Hurt, Jr., and C. A. Briscoe, Jr. 1969. "Insecticides evaluated in 1968 as sprays and anular applications for control of the alfalfa weevil." Miss. Farm Research 32(3):6.*

Disease Control

Planting resistant varieties and modifying cultural practices also are the first lines of defense against disease damage to alfalfa. Control by application of chemical sprays and dusts has been used infrequently.

Nematode Control

Submit soil samples to a nematologist for examination. Do not plant alfalfa if nematodes are present, because resistant varieties are the best control and varieties that do well in Mississippi are not resistant.

Harvesting

Producing alfalfa hay of the highest possible quality requires great care in cutting, conditioning and packaging for storage. Saving the most leaves possible is the primary goal and this is one of the most difficult of all crop harvesting jobs.

Alfalfa produces forage of highest quality when cut in the late-bud or early-flower stage of maturity and four to six cuttings can be made, depending on rainfall distribution. Average dry matter yields have ranged from 3.8 tons per acre with harvesting at the flower-bud stage of maturity (six cuttings per season) to 5.5 tons per acre with harvesting at full bloom (two cuttings per season). Leaves in the harvested forage decreased from 57% with harvest at the flower-bud stage to 45% with harvest at full bloom (Table 2). Cuttings after the initial spring harvest can be made at 30- to 40-day intervals, depending on th stage of maturity selected fo harvest. Harvesting should b discontinued after October 1, t allow plants to build up the roo system food reserves necessary fo stand maintenance.

A single operation for cutting conditioning and wind-rowin with pull-type or self-propelle machines is becoming popula (Figure 2). Conventional con ditioning, raking and baling afte mowing (Figure 3) still ar preferred by some farmers but ar being replaced gradually with th new mower-conditioner-winc rowers.

Table 2. Average dry matter yield and percent leaves of twelve varieties of alfalfa harvested at different stages of maturity over a period of 10 years in Mississippi.

Stage of Maturity	Avg. No. Harvests/Year	Dry Matter Yield lbs/Acre	% Leaves
Flower Bud	6	7652	57.1
1/10 Bloom	5	8464	54.3
1/4 Bloom	5	9030	50.3
1/2 Bloom	4	10120	47.5
Full Bloom	3	10720	45.0

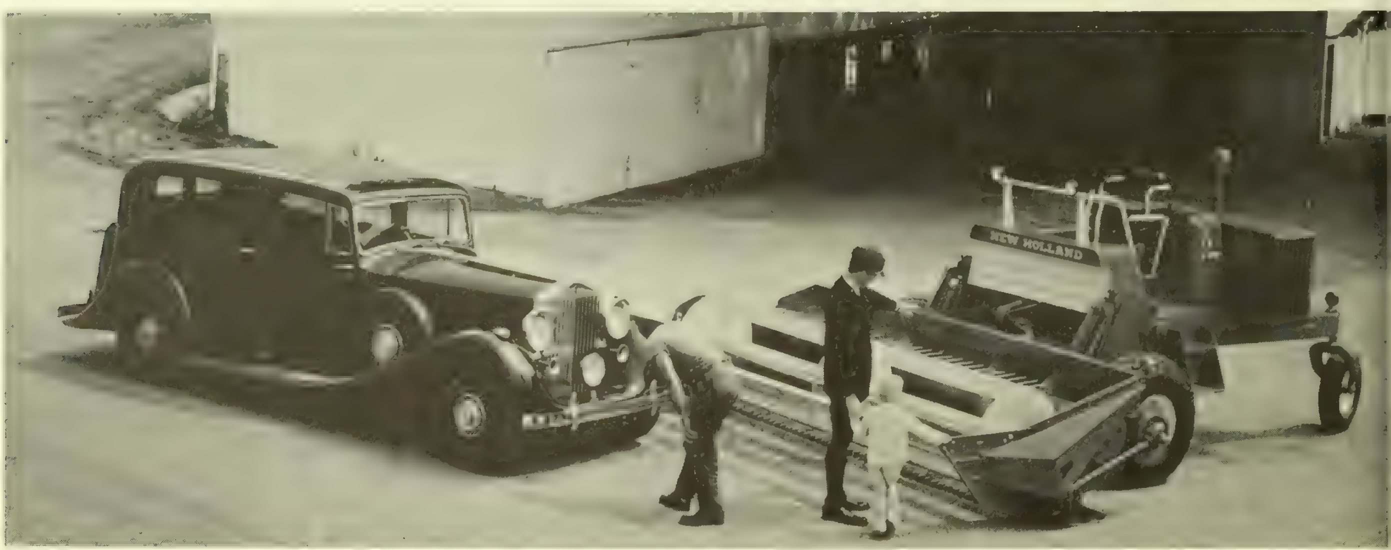

Figure 2. A self-propelled harvesting machine (right) for cutting, conditioning and windrowing alfalfa.

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[5] *Consult your county agent, area extension specialists or Mississippi Cooperative Extension Servi Information Sheet 722 for current recommendations for control of insects in alfalfa.*

REVIEW OF RESEARCH RESULTS

Fertility Requirements

Each ton of alfalfa hay contains 100-125 lbs of calcium or base equivalent (estimated) and this makes calcium content of the soil critical. A pH of 6.5 or above is necessary for maximum production and many otherwise adaptable soils require lime---most soils east of the Mississippi River require lime for successful alfalfa production.

High levels of plant nutrients also are necessary for maximum alfalfa production. Phosphorus and potassium are essential for root and shoot development and for stand survival. Applications of boron have meant the difference in high and low yields in some areas of the Southeast.

Alfalfa will provide the nitrogen needed if soils are properly limed and fertilized and seed are inoculated at planting time with the proper strain of nitrogen-fixing bacteria. Applications of molybdenum during the growing season also may stimulate plant growth because the bacteria require it for maximum nitrogen fixation.

The bacteria live in nodules (swollen root tissue) on the roots of alfalfa plants. Cut the nodules to check their activity. The cross section of the nodule will be red if bacteria are active and fixing nitrogen.

Varieties

Alfalfa cultivars grown in the Jnited States were developed from orms of *Medicago* that frequently re referred to as the *Medicago sa-iva* complex---*Medicago sativa* L. nd *Medicago falcata* L., both of hich are interfertile and may be lassified as subspecies of the same pecies. *M. sativa* is native to outhwest Asia, has purple flowers,

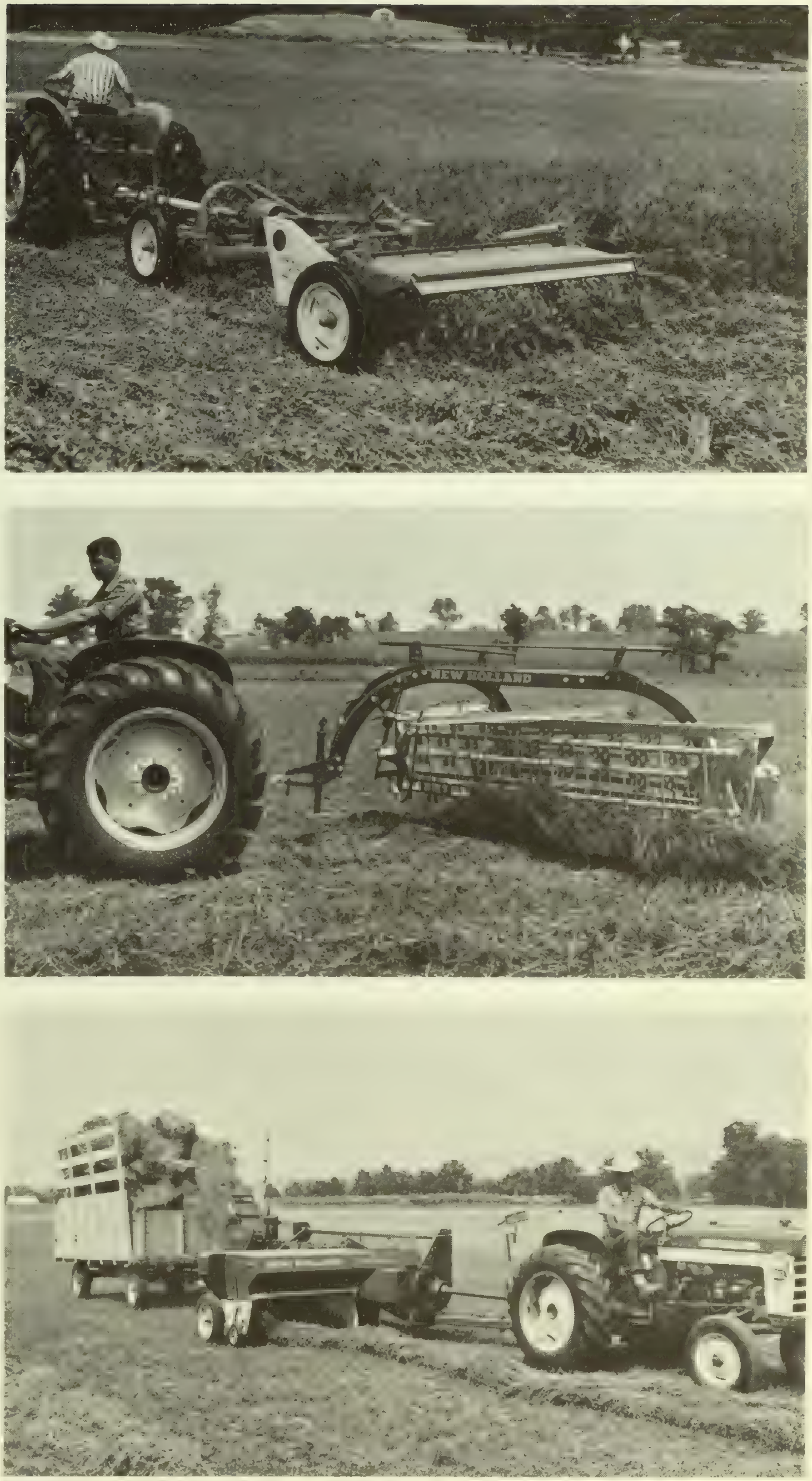


Figure 3. Some alfalfa harvesting is still done with separate cutting (top), raking (middle) and baling (bottom) operations.

and is erect with a narrow crown. Related alfalfas include Flemish, Turkestan and common types that vary in winter hardiness. *M. falcata* is native to Siberia, has a widely-branched root system, a deep-set crown with yellow flowers, and is more winterhardy than *M. sativa*.

Common---The common types originated from plants transported from Europe into South America in the 16th Century and then brought from Chile to California in the 1850's. The eastward and northward spread of people led to the evolution of established varieties in other areas. For lack of a better term, locally-grown alfalfa became known as "common." Kansas common and California common are examples. Common types are not recognized as varieties under the Federal Seed Act.

All South American common types have purple flowers and their cold hardiness ranges from none to intermediate. The non-winterhardy types are rapid growers, even in cool weather and make rapid recovery after cutting. They have little cold resistance but are very productive for hay and seed.

Variegated---The variegated types are believed to have originated from natural crossing of *M. sativa* and *M. falcata*. Flowers are purple, blue, yellow or white. Most cold resistant cultivars grown in Canada and the northern parts of the United States are variegated.

'Vernal' is a strongly-variegated variety with high levels of winter hardiness and resistance to bacterial wilt. It currently is grown on 25-30% of the alfalfa acreage in the North Central states. 'Cayuga' and 'Narrangansett' are varieties adapted to the northeastern states. 'Culver' is the only variety bred specifically for meadow spittlebug resistance. It is a 1959 release and has *M. falcata* in its genetic background.

Synthetics---Several synthetic varieties grown in Mississippi were bred from common varieties. 'Buffalo' is a bacterial wilt resistant synthetic developed from Kansas common and was released in 1943. 'Cody' is a synthetic from a selection within Buffalo and expresses aphid and bacterial wilt resistance.

'Ranger' is a synthetic variety developed in Nebraska for resistance to bacterial wilt. It was produced by intercrossing selected inbred lines from Cossack, Ladak and Turkestan. The Turkestan types are native to Turkestan (now USSR). These types have purple flowers and generally are very susceptible to leaf spot.

Flemish---The common alfalfas of northern France frequently are referred to as the Flemish types. Plants of this group have purple flowers and, although quick to recover after cutting, are only moderately winter hardy. 'Dupuits' possesses good vigor and moderate resistance to certain foliar diseases, but is highly susceptible to bacterial wilt and some crown rots.

Alfalfa Improvement

Alfalfa improvement was affected less than that of other species by the deemphasis of legume research about the middle of the 20th Century. The number of varieties developed through public and private breeding programs had almost doubled and more than 80 varieties of *M. sativa* had been released by 1972.

Plant breeders, entomologists and pathologists working as teams in the Southern Region developed 'Cherokee,' 'Team' and 'Arc.' These cultivars were bred for improved tolerance to the disease and insect complexes in the region. Arc carries resistance to southern anthracnose, several leafspots, pea aphids and weevils. 'Liberty' is the most recent release from the North Carolina breeding program. 'Victoria' was released by the Arkansas Agricultural Experiment Station in 1969. This 9-clone synthetic performs similarly to 'Buffalo,' 'Cody' and 'Vernal.' It is resistant to the spotted alfalfa aphid; has moderate resistance to common leaf spot, downy mildew and phytophthora root rot; and has measurable levels of resistance to bacterial wilt, potato leaf hopper and thrips.

Two regionally-adapted varieties were developed by extended selection under very humid conditions. 'Delta' originated through several generations of selections from plants that survived from original populations in old fields in the Delta of Mississippi. It has persisted longer in Mississippi tests and yields more than varieties from other areas. Similar efforts created 'Florida 66.' Exploitation of the potential of this variety was hampered by extreme susceptibility to the spotted alfalfa aphid in the area of seed production. However, a Florida 66 type with resistance to this aphid is planned for release within two years.

Private companies also have developed several varieties that are used in the Southern Region. Some companies with varieties and proprietaries developed for the Southeast are the FFR Cooperative, North American Plant Breeders, Northup, King and Company, and the Waterman-Loomis Company.

Insect Pests

Losses of alfalfa forage and seed resulting from insect damage have been reported to be as high as $260 million annually in the United States. Damage inflicted by insects feeding on alfalfa leaves, stems, roots and flowers causes reductions in plant vigor and plant stands. Some insects inject toxins into the

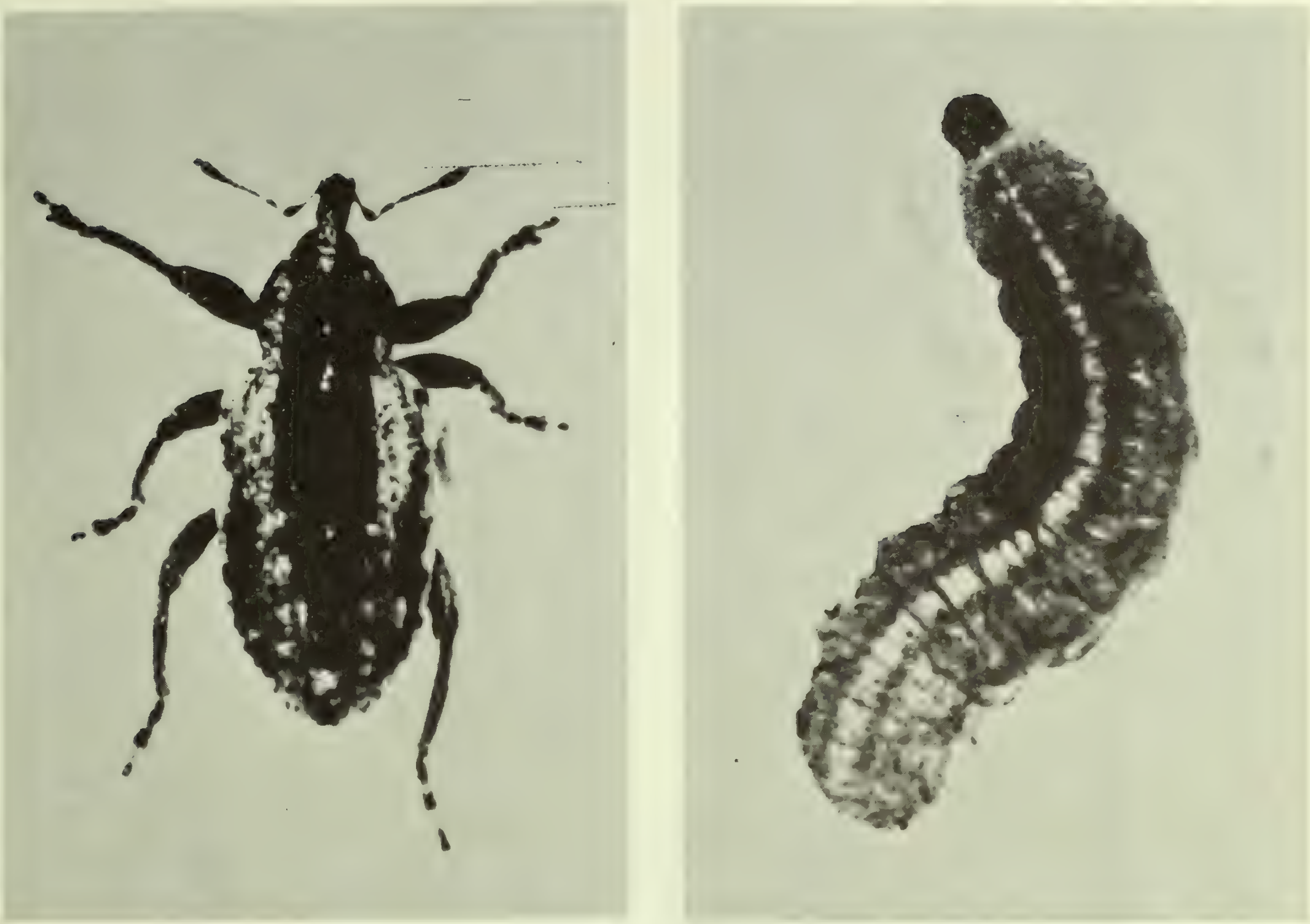


Figure 4. The adult alfalfa weevil (left) and the emerging larvae (right).

lant while feeding and these ubstances retard plant growth nd reduce forage quality. Yield nd quality also are reduced by nsects that attack the seed head irectly or spread disease-causing rganisms by feeding from plant to lant. Insects that damage alfalfa re classified as (1) chewing insects hat feed on leaves, buds and tems, (2) sucking insects that feed n leaves, buds and stems, and (3) ther insects.

hewing Insects

Alfalfa Weevil---The alfalfa eevil, *Hypera postica* (Gyllenhal) dark brown with a darker stripe xtending down the back for more han one half the length of the ody. The adult (Figure 4a) is about /16-inch long and has a snout ith chewing mouthparts.

Damage to alfalfa plants by the weevil is greater than that by any other insect. Most of the damage is caused by the larvae. Larval feeding reduces plant yield and forage quality by decreasing leaf area of plants.

Fully developed larvae change into pupae within cocoons attached either to alfalfa plants or to bits of debris on the ground. Adults emerge from the cocoons after one or two weeks and begin another cycle by mating and laying eggs.

The female chews holes in alfalfa stems into which she deposits 1 to 30 eggs of lemon-yellow color. The eggs turn darker as they mature and become brown before hatching. Eggs hatch in one to two weeks in warm weather but take longer in cool weather.

Emerging larvae are about 1/20-inch long and are yellowish with a shiny black head. They are 3/8-inch long after three to four weeks and are yellowish-green with distinct white stripes down their back (Figure 4b).

The alfalfa weevil usually produces one generation each year. Adults may leave the field and become inactive during the hot summer months but return in the fall to feed and lay eggs. Eggs in alfalfa stems and inactive adults in and around fields live through the winter. The eggs hatch and overwintered adults lay additional eggs when conditions are favorable the next spring.

Clover Leaf Weevil---Larvae of the clover leaf weevil, *Hypera punctata* (Fab.), resemble those of the alfalfa weevil; however, fully-grown larvae are about 1/2-inch long and more robust than alfalfa weevil larvae. They are greenish with a brown head and have a white or pinkish stripe down the back.

Adults are about 1/4-inch long, 1/8-inch wide, and mottled brown in appearance. The females lay their eggs singly in alfalfa stems. The eggs hatch in a few days and the larvae chew small holes in alfalfa leaves.

Larvae generally complete development in April or May. Mature larvae pupate in a net-like cocoon near the base of the alfalfa plant. Adults emerge in about 11 days, feed for a short period, and then become inactive during summer.

A fungus disease controls this insect in some areas.

Clover Head Weevil and Lesser Clover Leaf Weevil---These two insect pests are similar in appearance and have similar life cycles. Newly-emerged adults of both species are about 3/16-inch long. The light brown color of young adult clover head weevils, *Hypera meles* (Fab.), turns to darker brown and black as they grow older. Young adult lesser clover leaf weevils, *Hypera nigrirostris* (Fab.), are green or blue-green, but lose this coloration and resemble the clover head weevil as they grow older.

Females of both species deposit cream-colored eggs in slits cut in clover and alfalfa stems. Emerging larvae of both species are white with black heads, but their bodies become dingy-white, mottled-green or brown as they grow older and have a light-colored stripe or stripes extending the length of their backs. Fully-developed fourth-stage larvae spin a lacy white cocoon attached to mature foliage.

Both species spend winter and summer periods of inactivity in ground litter in and around fields and are active in clover and alfalfa fields only from mid-February until June. Therefore, they produce only one new generation each year.

Both species tend to congregate in clover fields; however, they are found in alfalfa in the spring. Damage to alfalfa results from the slits made for egg laying and from larvae feeding on buds. Symptoms of damage are stunted and malformed heads.

Sucking Insects

Aphids---The pea aphid, *Acyrthosiphon pisum* (Harris) and the spotted alfalfa aphid, *Therioaphis maculata* (Buckton), are the most prevalent aphids on alfalfa.

The spotted alfalfa aphid is pale yellow with four to six rows of dark spiny spots along the back. Nymphs resemble adults but are smaller.

Winged and wingless adults of both insects give birth to living young in warm weather. Each female is capable of producing 1 to 14 offspring each day without fertilization by males and a single female may give birth to 100 or more young during her life. The young may reach maturity in one week in summer. Therefore, as many as 10 to 20 generations may be produced each year if weather is favorable. Sexual winged females and males appear and produce eggs in cool weather. These eggs usually are laid on alternate host plants.

A toxic substance injected by spotted alfalfa aphids feeding on alfalfa causes yellowing of plants. Many leaves may be shed and growth of plants may be stunted by heavy infestations.

Nymphs and adults of both aphids usually are most numerous on the underside of leaves on the lower part of the plant. A honeydew secreted by the aphids while feeding attracts a black mold that reduces the quality of hay.

Threecornered Alfalfa Hopper---The adult threecornered alfalfa hopper, *Spissistilus festinus* (Say), has a triangular form, is light green and measures about 1/4-inch long. Nymphs are similar in shape but are straw colored or have a greenish tint and are covered with prominent projections, spines and hairs. Adults emerge from overwintering and deposit white oblong eggs in long slits on alfalfa stems. Time from egg laying to adult is about 50 days and there may be four generations in a year.

Feeding adults and nymphs make punctures in a circular pattern around alfalfa stems and these result in the formation of a callous tissue. Normal circulation of water is inhibited and plants may turn yellow, wilt and die. Stems also may break before harvest.

Leafhoppers---The genera of leafhoppers most abundant on alfalfa are *Agallia, Aceratagallia, Empoasca* and *Macrosteles*. Different species of these insects overwinter in different stages. However, they may become active during warm periods and reproduce in winter in Mississippi. Eggs laid in stems, buds or leaves hatch into wingless nymphs that resemble adults. The nymphs develop directly into adults.

Adults are slender and vary from 1/16- to 1/4-inch in length. They are mottled or speckled; green, yellow, brown or gray; and hop or fly ahead of anyone walking in a field.

Alfalfa plants show lack of vigor, leaves may become yellow and growth is retarded when leafhoppers are abundant.

Tarnished Plant Bug---Adult tarnished plant bugs, *Lygus lineolaris* (Palisot de Beauvois), are about 1/4-inch long and vary in color from pale greenish to yellow brown. They overwinter as hibernating adults that emerge and lay urved, elongated eggs in alfalfa lowers, buds and stems. Nymphs esemble adults but do not have ings. One generation requires 20 o 30 days, depending upon emperature.

Feeding by these insects causes lfalfa buds and flowers to fall and reduces seed quality.

Other Insects---The green cloverworm, *Plathypena scabra* (Fab.); corn earworm, *Heliothis zea* (Boddie); webworms, *Loxostege* spp.; spotted cucumber beetle, *Diabrotica undecimpunctata howardii* Barber; bean leaf beetle, *Cerotoma trifurcata* (Forster); armyworms; cutworms and grasshoppers infest alfalfa wherever it is grown. However, numbers usually are small and controls are not required.

Diseases

Diseases can be a factor in stablishing and maintaining rofitable stands of alfalfa, and ay shorten the productive life of tands. No single disease appears o be of great economic importance, ut the combined effect of diseases hat attack alfalfa can be serious. he incidence and severity of iseases normally increase when creage increases result in greater oncentration of alfalfa fields in an rea.

Some of the more prevalent iseases in alfalfa fields are:

eaf Diseases

Downy Mildew---Downy mildew s caused by the fungus, *eronospora trifoliorum* De Bary. he fungus produces spores that emain dormant in winter and erminate in spring.

The disease affects upper leaves f the plant first and symptoms are ight-green leaves with a grayish-hite, mold-like growth on both eaf surfaces. Leaves also may ecome twisted.

Downy mildew may weaken lfalfa plants by damaging them efore the first cutting.

Cercospora Leafspot---ercospora leafspot (*Cercospora edicaginis* Eil. and Er.) thrives nder warm and humid conditions. ymptoms are dark brown to black pots on the leaves. The spots pear ash-gray when humidity is gh and spores are on the lesions. Diseased leaves fall from the ant, resulting in reduced yields nd quality of hay. Cutting early (early bloom) will save some of the leaves and minimize yield reduction and quality depreciation of hay.

Alfalfa Mosaic---Alfalfa mosaic is a virus disease that aphids spread in the field. Symptoms are stunted plants with yellow and green mottling of the leaves. The disease is most prevalent in spring when it is cool and symptoms may not be observed in summer when it is hot.

Alfalfa Rust---Rust is caused by the fungus, *Uromyces striatus* Schroet. var. *medicaginis* (Pass) Arth. Leaves of diseased plants show reddish-brown masses (pustules) of fungus spores that break through the leaf surface. Pustules also may form on plant stems.

Damaged leaves shrivel and fall from the plant, resulting in reduced yields and quality of hay.

Stem Diseases

Crown and Stem Rot---Stem rot (*Sclerotinia trifoliorum* Eriks.) causes injury to the stem bases and crown branches near the soil line. The fungus develops over lesions and appears as a white-cottony mass during moist, cool weather. Diseased tissues become soft and discolored and plant tops wilt. Hard, black bodies (sclerotia) form in the fungus mat.

Control measures include planting seed free of sclerotia, plowing 8- to 10-inches deep to bury sclerotia, and clean cultivation.

Southern Anthracnose---Southern anthracnose (*Collectotrichum trifolii* Bain) symptoms appear in early summer as lesions on stems and petioles of alfalfa plants. Dark, spore-producing bodies develop in the center of the lesions. The lesions girdle stems and cause wilting and browning of plant parts above the girdled areas. This fungus attacks the crown and taproot and may kill the plant when conditions for its development are favorable.

The disease reduces plant vigor and quality of hay.

Sclerotial Blight or "Southern Blight"---Southern blight (*Sclerotium rolfsii* Sacc.) attacks the stem bases and crowns of alfalfa and is particularly evident in summer. Small, light-brown, spherical sclerotia of the fungus form on stems and crowns of plants. Plant parts above the infected area of the stem bleach to a tan color and die.

The disease is widespread in silty and sandy soils. Location of fields is important in combating this disease of alfalfa.

Root and Crown Diseases

Damping Off---*Phytophthora, Pythium, Fusarium* and *Rhizoctonia* are common soil fungi that attack and kill alfalfa seedlings either before or after they emerge from the soil. The disease is most severe in wet soils.

Bacterial Wilt---Bacterial wilt, caused by *Corynebacterium in-*

sidiosum (McCull) H. L. Jens., occurs in poorly drained soils. The disease causes stunted plants and an increase in the number of stems with smaller-than-normal diameter. It reduces the size of leaflets and turns them yellow. All woody parts of the plant show a brown color in advanced stages of the disease.

Fusarium Wilt---This is a fungus disease caused by *Fusarium oxysporium* Schlect. F. *medicaginis* (Weimer) Snyder et Hansen. Symptoms include bleaching of infected stem tissues, rapid wilting of plants in hot weather, and brown woody tissues. Appearance of fusarium wilt and bacterial wilt is somewhat similar.

Disease Control

Application of chemical sprays and dusts to control alfalfa diseases has been limited. Disease control measures that have been proven most successful are: (1) selection of land that offers the best defense against diseases known to be a problem in an area, (2) planting varieties with disease resistance and with tolerance to disease-spreading insects, and (3) modifying cultural practices to minimize damage from diseases.

Nematodes

Nematodes are very small, nonsegmented roundworms that move in soil water. They attack stems and roots of plants by piercing tissues with a needle-like mouthpart (stylet) while feeding. Two major species have been reported in alfalfa:

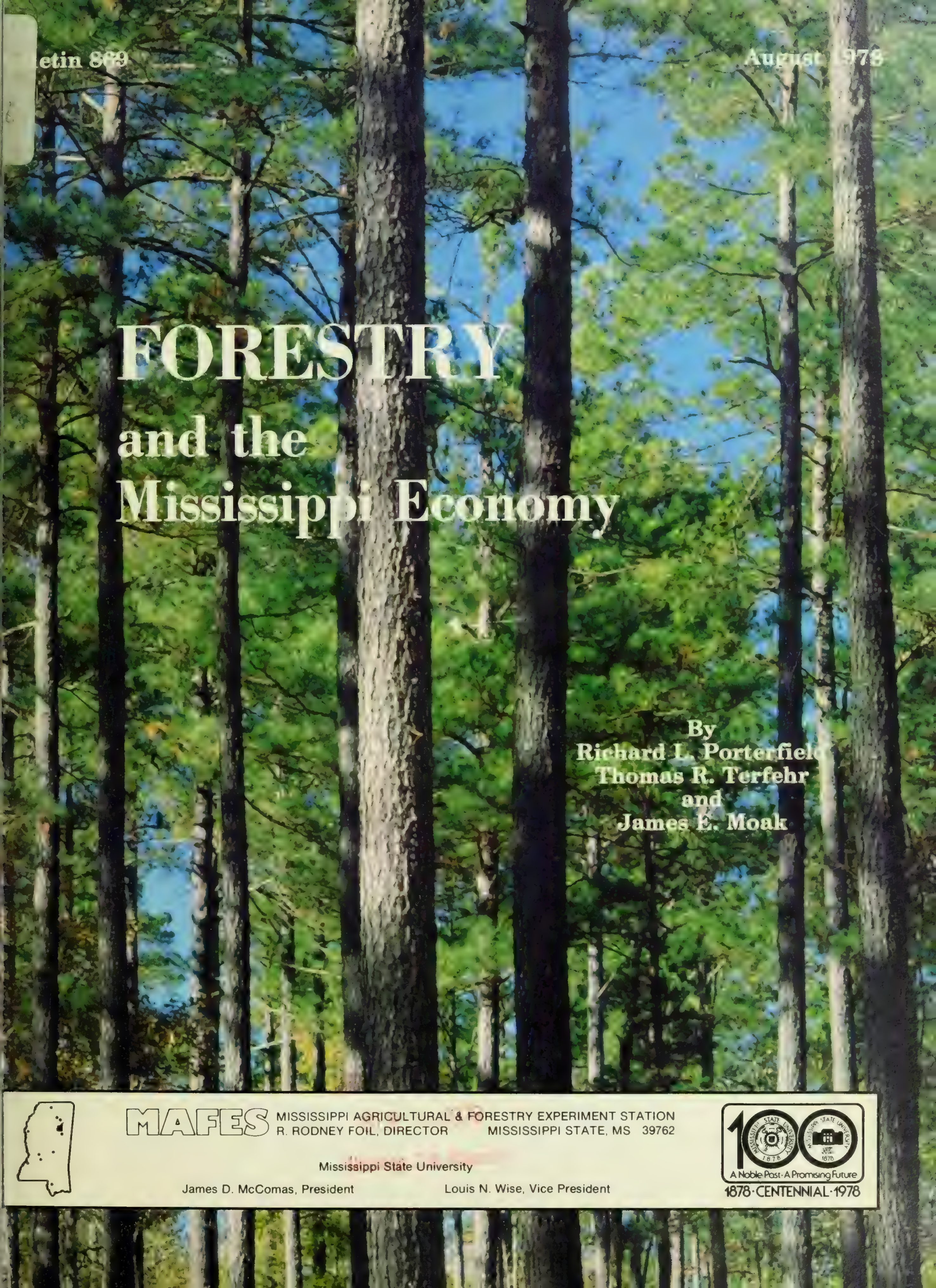
Stem Nematodes---The stem nematode (*Ditylenchus* Dipsaci Kuhn Filipjen) causes dwarfing, yellowing, wilting and distortion of alfalfa plants. Stems become swollen and brown at the base, and may break.

Three resistant alfalfa varieties have been developed: Lahontan, Washoe and Apalachee.

Root-Knot Nematodes---Symptoms of root-knot nematode (*meloidogyne* sp.) damage are galls or growths on the roots where they feed. These distortions decrease the amount of functional root area, which results in reduced uptake of water and minerals. Feeding lesions and damaged roots provide an entry for disease-causing bacteria and fungi that contribute to destruction of the plant.

Nematode Control

Determining whether nematode control is needed requires examination of soil samples by a nematologist. Planting resistant varieties is the best control and non-resistant varieties never should be planted if soil is infested with nematodes.



etin 869 August 1978

FORESTRY
and the
Mississippi Economy

By
Richard L. Porterfield
Thomas R. Terfehr
and
James E. Moak

MAFES MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
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A Noble Past · A Promising Future
1878 · CENTENNIAL · 1978

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Bulletin 869

Forestry and the Mississippi Economy

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Mississippi Agricultural and Forestry Experiment Station
Mississippi State, Mississippi

August 1978

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FORESTRY
and the
Mississippi Economy

SUMMARY

The purpose of this bulletin is to "tell the story" of Mississippi forestry in one publication. Obviously, everything cannot be covered in one publication but the breadth of treatment is sufficient to acquaint the reader with the ways in which the state's forests and forest industry influence the lives of Mississippians.

Availability of data needed to complete this study varied considerably, depending upon the factor or resource of interest. Generally, the study is based on 1975 data. (The exception is the input/output analysis which is based on 1974 data, the most recent available.) The 1975 statistics are probably conservative because 1975 was not a "typical" year for Mississippi forestry. For example, during the recession of 1975, total Mississippi employment fell 7% from 1974 levels, but forestry employment fell over 13%. Thus, the findings of this study leave little doubt about the essential role of forestry in Mississippi.

Highlights of the study are:

Mississippi's Forest Resources

1) Forests occupy 55% of Mississippi's land area.

2) Mississippi forests are well distributed over the state with the exception of the Delta.

3) The inventory of timber growing stock is slowly increasing.

4) Timber harvest has been increasing steadily.

5) Annual timber growth-harvest ratios indicate that growth and harvest are nearly equal for certain timber products and in certain regions of the State.

6) Mississippi's forest land is more productive than typical forest land throughout the South or the Nation.

7) Current per acre timber growth in Mississippi is only 60% of the potential growth of fully stocked natural stands.

8) Over 70% of Mississippi's forest land is in nonindustrial private ownership.

9) The use and the value of Mississippi forests for recreation are immense. Expenditures associated with just forestry-related hunting exceeded $36 million in 1973.

10) Nearly $14 million in ad valorem and severance taxes were paid on Mississippi forest land and timber harvested in 1976.

11) The ad valorem tax on Mississippi forest land is increasing rapidly.

The Private Nonindustrial Forest Landowner

1) "Factory workers", many of whom are former farmers and still live in rural areas, are the largest forest ownership sub-class; 2.4 million acres.

2) Ownerships of less than 50 acres in size account for 53% of all nonindustrial private forest land.

3) A non-timber objective is the

principal reason for forest land ownership by 48% of the nonindustrial private forest landowners.

4) Nonindustrial private forest landowners prefer selective or partial harvesting to clear cutting.

5) No constructive forest management practice has been performed on 40% of the privately owned nonindustrial forest land.

6) Nonindustrial private forest landowners are aware of forest services available but seldom us these services. The Mississipp Forestry Commission, for example offers a variety of services t Mississippi forest landowners.

Mississippi Forest Industry

1) Forest industry activity, like the forest resource, is well distributed over all regions of the State.

2) Over $327 million in wages were paid to about 45,000 forest industry employees in 1975.

3) One of every five manufacturing jobs in Mississippi is provided by forest industry.

4) The forest industry workforce generally is older, somewhat less educated, and more likely to live in a rural area than are other members of the Mississippi workforce.

5) The forest industry employs few females but has a high proportion of minority employment.

6) The forest industry has consistently led all other manufacturing industries in the State i terms of new capital investment in recent years.

7) Mississippi appears to hold substantial regional advantage i the production of paper products.

8) The forest industry has man hazardous occupations.

Forestry As Part of Mississippi's Overall Economy

1) Input/output analysis shows that forestry is an integral part of the Mississippi economy with major in-state purchases and sales.

2) The forest industry exported wood products valued at $655 million in 1974.

3) Forestry and forest industry activities *directly* supported 21,000 jobs outside the forestry sectors in 1974.

4) Expansion of the Mississippi forest products industry will have a positive impact on the State's economy:

a. For each $1 increase in final demand (sales) for forestry products total output of the Mississippi economy increase $3.56.

b. For each additional $1 pai as wages to forestry labor tota household income in Mississipp increases by $3.94.

c. For each new forestry jo created in Mississippi four to fiv new jobs become available in th non-forestry sectors.

The Future of Mississippi Forestry

1) Future demands for forest products are increasing in Mississippi and over the entire Nation.

2) Mississippi has the opportunity and potential capability to increase its share of the supply of forest products.

3) Expansion of the Mississippi forest products industry is unduly limited without change in the current level of forest resource management intensity. Using current annual softwood growth in excess of annual harvest would result in Statewide increases of only 0.7%, 0.8% and 1.2% in Mississippi's economic output, total household income and statewide employment, respectively.

4) More intensive forest resource management of Mississippi forest industry lands is feasible and would result in increases of 2.0%, 1.7% and 3.0% in Mississippi's economic output, total household income and employment, respectively.

5) Intensifying forest resource management of private, nonindustrial forest lands is the largest challenge and greatest opportunity for Mississippi forestry. Increasing the productivity of these lands under *ideal* conditions would raise Statewide economic output by 9.4%, increase income to Mississippi households by 8.2% and add 14.1% more jobs in Mississippi.

6) Forestry is long-term and the economic impact of more intensive forest resource management, in large part, cannot be considere immediate.

7) Intensification of fores management practices is a complex matter, particularly wit regard to small, private nonindustrial forest ownerships:

a. Efforts to intensify fores resource management must full recognize the multiple goals o ownership.

b. Low profitability and th long time period associated wit growing timber hinder management intensification. Incentiv programs are quite important.

8) A massive communicatio effort is needed to acquaint owner of forest land with their management opportunities and alternatives.

MISSISSIPPI'S FOREST RESOURCES*

Mississippi's forests are vast and vital. They serve as a foundation for the State's forest products ndustry and influence the lives of every Mississippian. In addition to supplying timber as a raw material for manufacturing, Mississippi's forests provide a multitude of recreational opportunities---hunting, camping, picnicking, nature walks and a host of other outdoor activities. Seldom recognized important benefits from the State's forests include their positive impact on water quality, soil fertility, erosion control and even the air we breath. These factors and the fact that forests are perpetually renewable combine to make Mississippi's forests one of Her greatest natural assets.

Forest land area and timber nventory

Forests occupy 16.7 million acres or 55% of the Mississippi landscape Van Hooser, 1973). These forests nclude natural stands of hardwoods, pines, mixtures of these, and man-created plantations, on a variety of sites. The U.S. Forest Service divides the State into five egions based on dominant forest species and physical geography Figure 1). Most data presented in his bulletin are summarized by hese forest inventory regions to facilitate identification of the contribution of forestry in each region o the total impact of forestry on the State's economy.

Each region of Mississippi has substantial forest land acreage Table 1). The Delta is least forested and has experienced the greatest change in forested acres in recent years. The increasing demand for soybeans led to extensive clearing of Delta forest land in the 1960's and early 1970's. However, preliminary results from the 1977 forest inventory in Mississippi indicate that the decline in forest land in the Delta has slowed and a period of stable forest land acreage is predicted.[1] Much of the recent clearing of forest land in other regions of the State has been to increase grazing acreage.

Mississippi's inventory of growing stock[2] increased from 10.3 mil cu ft in 1957 to 14.4 mil cu ft in 1976 (Table 2) but rate of growth has tended to decline with each estimate made since the 1967 inventory. However, preliminary data from the 1977 inventory indicate that earlier estimates may be conservative. For example, the new inventory predicts a 21% increase in the Delta since 1967 and a 78% gain in softwood volume in the North in that period.[3] Also, the 1976 estimate of growing stock in the State includes an estimate of 3.1 mil cu ft in the North, considerably less than the 3.9 mil cu ft indicated by the 1977 inventory. Therefore, the rate of increase in total inventory appears to have slowed but there is little doubt that growing stock volume in the State still is increasing. Similarly, the 1976 estimates indicate that the

Table 1. Commercial Forest Land Area, by Survey Region, Mississippi, 1973.

U. S. Forest Service Survey Region	Number of Acres of Commercial Forest Land	Forest Land as % of Total Land	Change in Forest Land Acreage since 1967
	(1,000)		%
Delta	1,307	23	-13
North	4,142	51	- 1
Central	4,056	68	+ 2
South	4,447	72	- 1
Southwest	2,749	63	0
Mississippi	16,700	55	- 1

Source: Van Hooser, 1973

***A more detailed description of study results is available from the senior author, Department of Forestry, Mississippi State University.**

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[1] *Paul A. Murphy, "Mississippi's Fifth Forest Survey---A Preview." Paper presented at the Mississippi Forestry Association Annual Meeting, Jackson, MS, October 20, 1977.*

[2] *See the Glossary for the definition of this and other terms used throughout this publication.*

[3] *See Footnote 1.*

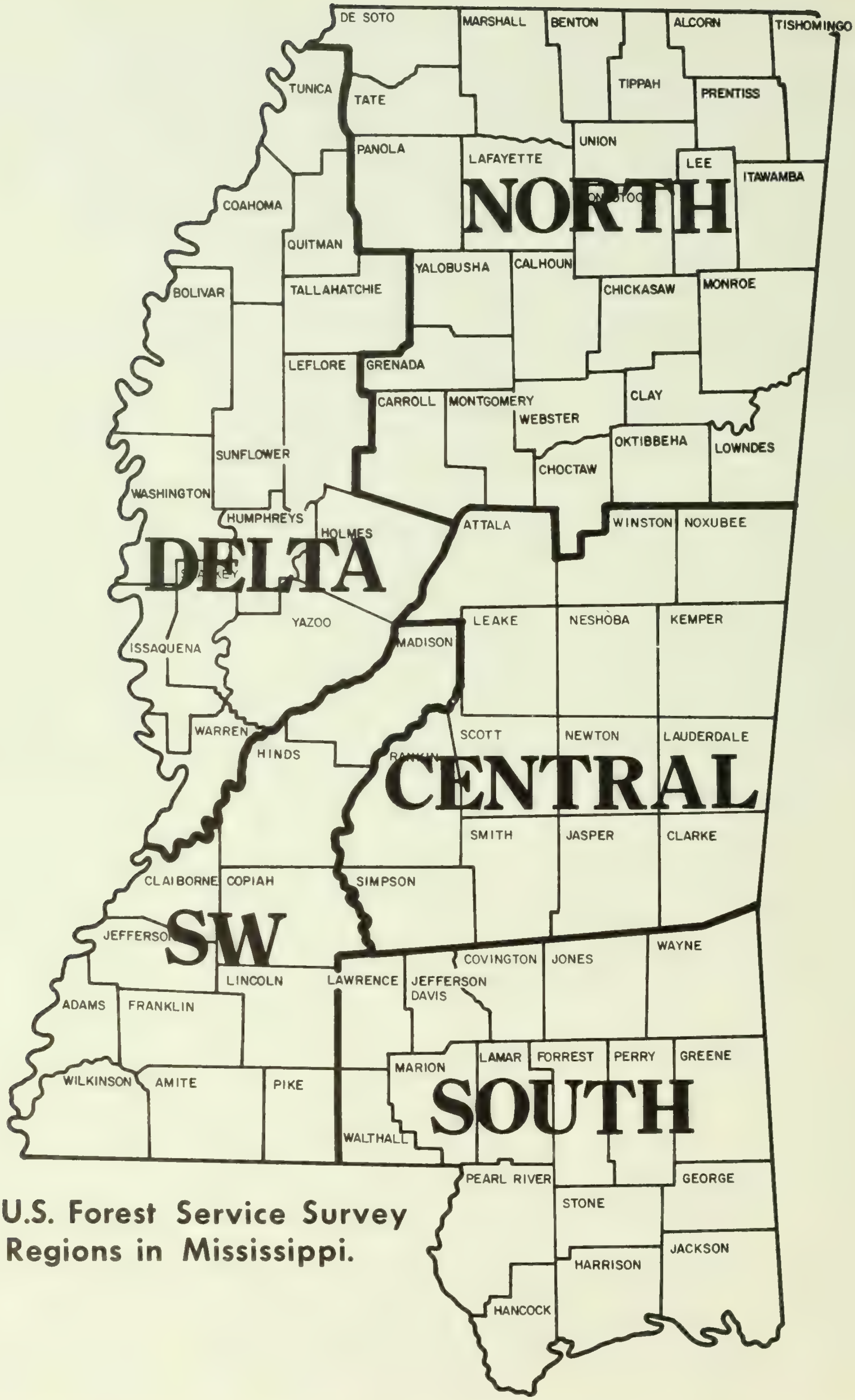
NORTH
DELTA
CENTRAL
SW
SOUTH
DE SOTO
MARSHALL
BENTON
ALCORN
TISHOMINGO
TUNICA
TATE
TIPPAH
PRENTISS
PANOLA
LAFAYETTE
UNION
LEE
ITAWAMBA
PONTOTOC
COAHOMA
QUITMAN
YALOBUSHA
CALHOUN
CHICKASAW
MONROE
BOLIVAR
TALLAHATCHIE
LEFLORE
GRENADA
CARROLL
MONTGOMERY
WEBSTER
CLAY
OKTIBBEHA
LOWNDES
SUNFLOWER
CHOCTAW
WASHINGTON
HUMPHREYS
HOLMES
ATTALA
WINSTON
NOXUBEE
SHARKEY
YAZOO
LEAKE
NESHOBA
KEMPER
ISSAQUENA
MADISON
WARREN
HINDS
SCOTT
NEWTON
LAUDERDALE
RANKIN
SMITH
JASPER
CLARKE
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
COVINGTON
JONES
WAYNE
LINCOLN
LAWRENCE
JEFFERSON DAVIS
ADAMS
FRANKLIN
MARION
LAMAR
FORREST
PERRY
GREENE
WILKINSON
AMITE
PIKE
WALTHALL
PEARL RIVER
GEORGE
STONE
HARRISON
JACKSON
HANCOCK

Figure 1. U.S. Forest Service Survey Regions in Mississippi.

olume of sawtimber in the State is creasing slowly.

The Central, South and outhwest regions of the State ntain 82% of the softwood growing stock inventory and the Central region alone contains 30% of the State's softwood volume. The Delta and North regions are dominated by hardwood species, with 94% of the Delta's total timber volume in hardwood species and 26% of the State's total hardwood inventory in the North.

roductivity and ownership f forest land

The State's favorable climate d soils provide for rapid timber owth and the productive poten- l of Mississippi forest land is gh. For example, 46% of Mis- sippi's forest land is capable of oducing 85 cu ft or more of wood r acre per year---only 34% of all S. forest lands and 35% of all rest lands in the South have this tential (Table 3). Mississippi has er 2 million acres of forest land pable of producing 120 cu ft or ore of wood per acre per year. ese estimates are based on the oductive potential of sites oc- pied by fully-stocked natural ands. Therefore, timber growth uld be higher under plantation anagement and/or if forest fer- ization, forest genetics, improved ilization, or other such forest anagement practices are ployed.

A major change in ownership of rest land in Mississippi has been e transfer from farmers to other ivate nonindustrial owners. ese two ownership classes con- olled 75% of the State's forest land 1967 (Table 4) and results of a cent survey by the Mississippi orestry Association indicate that e Mississippi forestry industry pends upon this acreage for 80% its wood needs. Only 15% of the rest land in the State is owned by e forestry industry but the oportion varies by region, being ghest in the South and lowest in e Delta.

The estimated average net owth of 52 cu ft/acre/year on the .7 million acres of forest land in ississippi is only 60% of potential owth (based on productive poten- al of fully-stocked natural

Table 2. Trends in Growing Stock Volume of Mississippi Forests.[1]

Year	Softwood	Hardwood	Total
	-------------million cubic feet-------------		
1957	4,021	6,291	10,312
1967	6,555	6,479	13,034
1973[2]	7,133	7,042	14,175
1975[3]	7,161	7,111	14,273
1976[3]	7,187	7,205	14,393

[1] Data for 1957 and 1967 are from U. S. Forest Service Timber Inventories. The latest inventory was completed late in 1977 and only preliminary data were available when this report was prepared.

[2] Data from a mid-cycle inventory and some change due to modification of measurement standards are reflected in the increase from 1967 to 1973.

[3] A forest service best estimate projection based primarily on severance tax reports and stand simulation techniques using growth rates from the 1973 survey.

Table 3. Productive Potential of Forest Land, United States, Southern United States and Mississippi.

	Capability of Forest Land as Measured by Growth Potential in Cubic Feet/Acre/Year				
Region	165	120 - 165	85 - 120	50 - 85	50
	(percent of total forest land)				
United States	3	8	23	40	26
Southern U.S.	1	6	28	46	19
Mississippi	3	9	34	47	7

Sources: U. S. Forest Service, 1973; Van Sickle and Van Hooser, 1969

Table 4. Acres of Forest Land, by Ownership Class, with Comparisons, Mississippi 1967.

Ownership Class	Acres Owned	Percent of Total
	(million)	
Public	1.7	10
Forest Industry	2.5	15
Farmer	6.2	37
Other Private	6.3	38
Total	16.7	100

Table 5. Actual and Potential Growth of Forests in Mississippi, with Comparisons.

Ownership Class	Mississippi Actual Net Growth	Mississippi Potential Net Growth[1]	Actual as a Percent of Potential Miss.	Actual as a Percent of Potential Southern U.S.	Actual as a Percent of Potential U.
	(cubic feet per acre per year)				
National Forests	69	100	69	75	39
Other Public	64	96	67	61	57
Forest Industry	55	91	60	64	59
Farm and Other Private	49	87	56	55	49
	---	---	---	---	---
All Ownerships	52	87	60	57	49

[1] The sum of site class capability times the proportion of acreage in that site class. Midpoin capability was used for each class except for the 165 cubic feet and greater and 50 cubic feet and les classes for which 175 and 40 cubic feet were used, respectively.
(Sources: Van Sickle and Van Hooser, 1969; U. S. Forest Service, 1973; President's Advisory Pan on Timber and the Environment, 1973).

stands), but slightly better than the ratios of actual growth to potential growth for the Southern United States and nationwide (Table 5). Production of privately-owned forests in Mississippi is lower than that of national forests and other public forest lands. The least productive forests in the State are on the 12.5 million acres controlled by farmers and other private non-industrial owners. Understocking is the major reason for grow below potential. Nearly 88% Mississippi's forest land was l than 60% fully stocked w desirable species in 1967 (V Sickle and Van Hooser, 1967).

Timber harvest

Mississippi's total timber harvest has increased substantially since 1965. The 1974 harvest was the highest in recent years, followed by the general recession-related slowdown in 1975 (Table 6) and a recovery in 1976 to 70% above the 1965 harvest. Cubic foot volumes of sawtimber and pulpwood harvested in 1975 were about equal. The cut of softwood species was slightly more than twice that of hardwood species (Table 7). The hardwood sawtimber harvest is primarily in the Delta and North survey regions where hardwood volume is most abundant. The hardwood pulpwood cut, on the other hand, is principally in the Central, South and Southeast survey regions because of proximity to the larger pulpwood markets of southern Mississippi. The Central region leads in the production of softwood for both sawtimber and pulpwood.

Table 6. Volume of Timber Harvested in Mississippi Selected Years, with Comparisons.

Year	Volume Harvested	Increase Over 196
	000 cu ft.	%
1965	374,120	---
1970	590,061	58
1974	675,265	80
1975	545,082	46
1976	637,172	70

Table 7. Mississippi's Timber Harvest, by Product, Specie Group and Survey Region, 1975.

Region	Sawtimber Softwood	Sawtimber Hardwood	Pulpwood Softwood	Pulpwood Hardwoo
	(MBF)[1]		(Cords)	
Delta	6,331	68,957	41,985	101,769
North	76,527	82,078	441,180	139,502
Central	262,591	59,406	837,790	427,617
South	166,973	20,982	799,270	219,869
Southwest	167,767	51,182	458,037	284,068
Total	680,189	282,605	2,578,262	1,172,825

[1] 1,000 Board Feet

Table 8. Ratios of Annual Growth to Timber Harvest, by Inventory Class, Species Group and Survey Region, Mississippi, 1975.

	Ratio of Volume Growth to Harvest[1]			
	Total Growing Stock		Sawtimber only	
Region	Softwood	Hardwood	Softwood	Hardwood
Delta	1.4	1.8	0.9	1.8
North	1.2	1.4	1.1	1.3
Central	0.9	1.2	0.8	1.3
South	1.1	1.5	1.0	1.4
Southwest	1.2	1.3	1.3	1.1
Weighted average	1.1	1.4	1.1	1.4

[1] Ratios are interpreted as follows: The weighted average of 1.1 for softwoods (for total growing stock and for sawtimber only) means that 1.1 cu. ft. of softwood was being grown for each cu. ft. harvested in 1975, or that average softwood growth in the state exceeded harvest by 10% in that year.

These ratios are based on the latest available estimates and likely will be revised when data from the 1977 U.S. Forest Service survey become available.

Table 9. Value of the Mississippi Timber Harvest, by Survey Region, 1975.

Region	As Standing Timber	Delivered to Mill (f.o.b.)
Delta	$ 5,457,885	$ 13,508,024
North	10,158,481	24,744,128
Central	35,749,673	74,678,883
South	26,345,098	57,386,161
Southeast	22,971,219	46,632,022
Total	100,682,356	216,949,218

Annual growth-harvest ratios

Ratios of annual volume growth o harvested volume indicate that nnual harvest in Mississippi is pproaching annual growth, paricularly for softwood species Table 8). Both softwood categories n the Central region and the oftwood sawtimber component of he Delta actually are being arvested faster than new growth s occurring and growth just natches harvest of softwood sawimber in the South survey region.

The ratios of growth to harvest eflect the relatively slow recent rowth of timber inventories. Because current growth is only 60% f potential growth statewide (Table 5), timber growth conceivably could be improved by better timber management. This would, however, require a genuine long-time commitment by the farmers and other private nonindustrial owners who control 75% of the State's forest land.

One method of improving growth-harvest ratios immediately is to use existing timber supplies more fully. An estimated 55 million cu ft of growing stock (12% of harvested volume) remained in the woods as logging residue in Mississippi in 1966 (Van Sickle and Van Hooser, 1969). Use of hardwoods is particularly poor, with logging residue typically amounting to about 20% of harvested volume. Use of multiple-product, tree-length harvesting would "stretch" timber supplies by 10 to 15% (Porterfield and von Segen, 1976). More complete harvesting also lessens the general public's negative reaction to the immediate post-harvesting scene.

Growth-harvest ratios also can be improved by making more complete use of timber delivered for processing. Small sawmills, for example, produce unused residues amounting to an average of 20% of their volume of log purchases.

Table 10. Taxes Paid by Mississippi Forest Owners, by Taxation Category and Survey Region, Mississippi, 1976.

Region	Severance Tax	Advalorem Tax on Forest Land[1]	Fire Protection Tax[1]	All Taxes
Delta	$ 90,400	$ 711,023	$ 27,722	$ 829,145
North	301,641	2,728,293	83,904	3,113,838
Central	632,066	2,725,540	79,190	3,436,796
South	548,020	3,624,987	85,046	4,258,053
Southwest	370,425	1,809,453	55,094	2,234,972
Total	1,942,552	11,599,298	330,956	13,872,804

[1] Estimates derived using the number of commercial forest land acres from Van Sickle and Var Hooser (1969).

Timber value

Value of the 1975 harvest delivered (f.o.b.) to the first processing plant was more than $200 million (Table 9). Value of the harvested wood as uncut raw material still standing in the woods (stumpage) was more than $100 million, much of which was paid to farmers and other private nonindustrial forest land owners. These values are considerably below those of the 1976 and 1977 harvests because the volume harvested in 1975 was much below the average of recent years and prices reflect the recession-related slowdown 1975. For example, the stumpa value of the 1975 harvest wou have been $150 million at 19 prices.[4]

Public revenue from forest lands

The direct contribution of Mississippi's forests to the support of government services in the State is significant. Funds for this come from transfer of receipts from sale of timber from national forests, from sales of timber from 16th section land, and from severance, fire protection and ad valorem taxes.

The 1.1 million acres of national forest land in Mississippi are not taxed but counties from which stumpage is cut receive 25% of the receipts in lieu of ad valorem taxes. These in lieu payments totaled $1,553,758 in 1975, with distribution among the survey regions as follows: North, $108,653; Delta, $8,722; Central, $166,557; Southwest, $648,515; and South, $621,311. Also, timber harvested from more than 300,000 acres of 16th section forest land provided in excess of $2.1 million in direct payments to local governments in 1976.

Timber is taxed when it is cut (severance tax), forested land is subject to a 2 cent/acre/year fire protection tax, and the land upon which timber grows is taxed annually (ad valorem tax). Taxes on timber and forest land in Mississippi totaled $13.9 million in 1976 (Table 10). Forest land owners in the South survey region paid more taxes than owners in any other region; however, severance tax collections were highest in the Central region.

Ad valorem taxes on forest land in Mississippi currently are of great concern because of recent increases in the rate applied to forested (classified as uncultivable) land. Average ad valorem taxes per acre of uncultivable and cultivable lands, respectively, were $0.60 and $1.45 in 1974, $0.63 and $1.53 in 1975, and $0.72 and $1.58 in 1976. The change from 1974 to 19 represents increases of 5.0 and 5. for uncultivable and cultivab land, respectively. However, t 1975 to 1976 increase was 3.3% f cultivable land and more tha 14.3% for uncultivable lar Regionally, the rate of change f cultivable and uncultivable la diverged importantly from t State average. For example, the valorem rate on the more than million acres of forest land in t Central region increased 22% ($.0 to $0.72 per acre) from 1975 to 19 but remained at $0.93 on cultivab land.

Ad valorem taxes are annu costs that have a tremendo impact on forest investme decisions because of the long tir period required for timber produ tion. The tax paid each year mu be compounded at the market ra of interest until timber harvested, and total tax is mu

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[4] Stumpage value of the record 1974 harvest would have been $180 million at 1977 prices.

Table 11. Recreation Visits to National Forests, by Activity and Region, Mississippi, 1975.

	Region					
Activity	North	Delta	Central	Southwest	South	Total
	visitor days					
Camping	67,400	3,800	10,100	17,800	55,900	155,000
Picnicking	24,300	200	4,000	5,000	9,200	42,700
Swimming	41,100	---	5,000	3,600	9,200	58,900
Hunting	146,900	9,900	65,900	26,200	60,800	309,700
Fishing	19,500	1,100	8,500	2,400	13,000	44,500
Gen. Dispersed	95,700	800	36,800	6,900	126,000	269,200
Total	394,900	15,800	130,300	61,900	274,100	**877,000**

ore than the annual rate times umber of years until harvest. For xample, total cost of a 72 cent/acre/year ad valorem rate for a 30-year rotation and a 10% interest rate is $118.44,[5] $96.84 more than the $21.60 resulting from multiplying the rate by years to harvest.

on-timber orest resources

Grazing, nature walks, wildlife hotography, hunting and a host f other activities add substantial- to the value of Mississippi's orest lands. However, the value of on-timber forest resources can be stimated only crudely because uch uses generally do not have stablished market prices and nventory or use data from which to egin assessment are sparse.

The 1.1 million acres of national orest land in the State are an xception to the above because umbers of visitor days are record- d (Table 11). The North survey egion, which includes the Holly prings and Tombigbee National orests, has the greatest recreation se. Participation in each activity eported in Table 11 is projected to ncrease in the future (U.S. Forest ervice, 1977).

Mississippi state parks and istoric sites are administered by he Mississippi Park Commission. ecorded visitations (not visitor ays as recorded for national orests) reached a record high of 4.3 illion in 1975. The major purpose 87%) of these visitations was for day-use activities such as picnicking. Native Mississippians accounted for 85% of the visitations in 1975.

Water and forage are valuable resources on all forested acres throughout the State. Water yield from national forests alone, for example, is about 2 million acre feet annually (65 billion gallons of good-quality water). More than 6,000 cattle grazed national forests in 1975 and an appreciable increase in demand for grazing on forest lands is forecast. However, the largest anticipated increases in demand on Mississippi national forests are for timber and recreation.

Mississippi has a large and diverse game resource and most species use forest land for food and/or cover. Forest-related game species include rabbit, squirrel, raccoon and woodcock as small game, deer and turkey as big game species. The 1971 white-tail deer population in Mississippi was estimated to be 250,000 and increasing. The turkey population was estimated to be 53,000 (Halls and Stransky, 1971).

The dominance of hunting as a non-timber use of national forests (Table 11) is true for forest land throughout the State. According to a 1972 study of 636,700 households, at least one member of 35% of Mississippi's households participates in some form of hunting activity (Horvath, 1974). A questionnaire completed as part of this study identified almost 2 million acres of industrial forest land open to hunting, and the sample was not exhaustive. More than 1.4 million (70%) of the 2 million acres were available to hunters on a permission only basis, with no fees charged. The 1975 game harvest from the 270,000 acres in wildlife management areas maintained by a single Mississippi company included 1,500 deer and 425 turkeys.

Crude estimates of the value of hunting in Mississippi's forests can be made from examination of expenditures for licenses and by abstracting from results of two studies---one by the Environmental Research Group of Georgia State University (Horvath, 1974) and one by the Mississippi Game and Fish Commission. Total fees from sales of licenses (combination hunting-fishing licenses and hunting licenses specific to game found in forests) amounted to $2.6 million in 1975. Hunters spent over 3 million days afield in Mississippi forests in 1972 and estimated their expenditures conservatively at $35 million (Table 12). Estimated value of forest-related hunting exceeded $100 million in 1972.

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[5] *This is a pre-income tax calculation. The amount after income tax would be less depending upon the tax racket of the individual or firm.*

Table 12. Days Afield, Expenditures and Value Received Hunting, Mississippi, by Game Species, 1972-1973.

Item	Small Game	Large Game	All Game
	(1,000)		
Days Afield (No.)	2,233	985	3,218
Expenditures[1] ($)	22,352	12,696	35,048
Value Received[2] ($)	68,178	39,262	107,440

[1] Include only variable costs . . . i.e., such items as travel to sites, shells, and licenses.

[2] Value placed on the hunting activities by the participants.

Source: Horvath, 1974 and unpublished results of a mail survey conducted by the Mississippi Game and Fish Commission.

PRIVATE NONINDUSTRIAL FORESTS

The future of Mississippi forestry will be determined largely by levels of management practiced on the 12.5 million acres of forest land in the hands of private nonindustrial owners. Levels of management will in turn be governed by the occupations of the individual landowners, their age, education and income level, their reasons for owning forest lands, and their receptivity to management assistance programs. T characteristics of owners su marized below are abstracted fro several studies of individuals w own forests ranging in size from to 500 acres.

Ownership

A distinctive characteristic of private nonindustrial forest owners is their occupation. The 2.4 million acres owned by "factory workers" account for almost o fourth of the forest acreage in t hands of private nonindustri owners in Mississippi and 32% the private nonindustrial owne in the State are "factory worker (Table 13). About 85% of th occupation group were on farmers and still live on their ru properties. The shift from "farme ownership to "factory-worke ownership likely will continue Mississippi becomes more i dustrialized.

"Retirees" also own about 2 million acres of forest land but th occupation group accounts for on 23% of the private nonindustri owners in the State. "Busines men" and "professionals" co bined account for 17% of all owne but control 2.3 million acres forest lands. Only 9% of the priva nonindustrial owners a "housewives" but they own almo 1 million acres.

Occupation of owners a

Table 13. Number of Owners, Percentage of Total Owners and Acreage Owned, Private Nonindustrial Owners of 20 to 500 Acres of Forest Land, by Occupation of Owners, Mississippi.[1]

Occupation	No. of Owners	Percentage of all Owners	Total Forest Acres Owned
Factory Workers	38,176	32	2,404,400
Retirees	27,439	23	2,366,400
Farmers	19,088	16	1,683,200
Businessmen	13,123	11	1,577,000
Housewives[2]	10,737	9	905,200
Professional	7,158	6	728,300
Other	3,579	3	249,500
All Occupations	119,300	100	9,914,000

[1] Ownerships less than 20 acres and greater than 500 would bring total private, nonindustrial ownership in Mississippi to 12.5 million acres (see Table 7).

[2] All women who hold deeds to forest land and are housewives.

Source: Survey by the Mississippi State University Forestry Department.

Table 14. Distribution of Ownership of 20-to-500 Acres, Private Nonindustrial Forests, by Occupation of Owners, Mississippi.

	Acres Owned						
Occupation	**20-49**	**50-89**	**90-159**	**160-269**	**270-429**	**430-500**	**Total**
	Percent						
Factory Workers	61	26	11	2	0	0	100
Retirees	48	31	11	8	0	2	100
Farmers	52	25	12	6	5	0	100
Businessmen	38	18	23	14	5	2	100
Housewives	64	18	6	6	6	0	100
Professional	48	19	24	0	9	0	100
Other	54	23	23	0	0	0	100
All Occupations	53	25	13	6	2	1	100

Source: Survey by the Mississippi State University Forestry Department.

acreage owned tend to be related directly to levels of timber management on private nonindustrial forest lands. Forest management opportunities are very limited for owners of small tracts (20-50 acres) and are even more limited for many, if not most, small ownerships because their acreage is not in a single tract but is split by fields, pastures, roads and other uses of land associated with farming. Also, many small tracts that are part of a farming operation consist of narrow uncultivable strips of woodland along stream bottoms. This acreage contributes little to timber supplies but is of great importance for wildlife habitat.

More than one half of the private nonindustrial forest ownerships in Mississippi are smaller than 50 acres and almost 80% are smaller than 90 acres (Table 14). However, total acreage in the smallest ownership category approaches 2 million and the combined acreage of the two smallest ownership categories is 3.7 million of the 9.9 million acres in the 20- to 500-acre ownership range. Percentages of owners with less than 50 acres are highest for "housewives," "factory workers" and "farmers." Percentages of owners with 160 acres or more are higher for "businessmen" than for other occupation categories.

Land is an asset and landowners with higher asset levels are known to practice more intensive forestry. Therefore, the combined acreage of an owner's forest land and other land is an important determinant of levels of intensity of forest management. The average "businessman" forest owner controls more total land and more forest land than do owners in any other employment category (Table 15); "housewives" own the smallest acreage of total land and forest land ("other" occupation category excluded).

Studies have shown that higher levels of educational attainment and total income of forest owners are associated with higher levels of forest management. The "businessmen" and "professionals" who own forest land in Mississippi have more formal education and earn higher incomes than forest land owners with other occupations (Table 16). "Businessmen" and "professionals" also are slightly younger than forest land owners with other occupations ("other" occupation category excluded).

Table 15. Average Size of Total Land and Forest Land Ownerships, Private Nonindustrial Owners of 20 to 500 Acres of Forest Land, by Occupation of Owners, Mississippi.

Occupation	Average Acres Forest Land	Average Total Acres Owned
Factory Workers	63	131
Retirees	86	135
Farmers	88	195
Businessmen	121	206
Housewives	84	125
Professional	102	153
Other	70	97
All Occupations	83	150

Source: Survey by the Mississippi State University Forestry Department.

Table 16. Age, Formal Education and Annual Income, Private Nonindustrial Owners of 20 to 500 Acres of Forest Land, by Occupation of Owners, Mississippi.

Occupation	Average Age	Average Education	Average Annual Income
	Years	Years	
Factory Workers	53	10	$ 7,700
Retirees	63	10	4,700
Farmers	53	11	7,700
Businessmen	51	14	10,500
Housewives	59	11	6,500
Professional	48	14	11,200
Other	52	11	7,000
All Occupations	55	11	7,400

Goals of ownership and levels of management

One major objective of a Mississippi State University Forestry Department study was to determine why private nonindustrial owners acquire and retain ownership of forest lands. The study revealed that most owners (83%) had bought their land, the others had inherited it. Timber production was given as the major use by 52% of the land owners. Grazing was reported as the major use by 29% of the respondents and 12% reported a home site as the primary reason for owning forest land (Table 17). Many forest owners reported up to 100 acres exclusively for a home site; however, 73% of the holdings used primarily as residential sites were smaller than 50 acres.

Percentages of owners reporting timber production as their primary goal were higher for "farmers" and "professionals" than for other occupational groups. Grazing was reported as the primary use of forest lands held by "factory workers." Most respondents in all occupational categories reported using their forest lands for more than one purpose.

The fact that only slightly more than one half of the owners had timber production as a primary goal suggests that intensity of management practices would below on many ownerships and this was confirmed by the study. No timber management practice had been performed by 40% of the owners and performance of individual management practices ranged from 3% for prescribed burning to 29% for timber stand improvement (Table 18). However some owners in each occupation category performed more than one practice; therefore, management level indices were computed (indices for each occupation category ranged from 0 for no management practice to 11 for the highest levels of management activity, such as

Table 17. Major Reasons for Ownership, Private Nonindustrial Owners of 20 to 500 Acres of Forest Land, by Occupation of Owners, Mississippi.

Occupation	Major Reason for Ownership						
	Timber Production	Grazing	Residence	Recreation	Clearing for Agriculture	Miscellaneous	Total
	Percent						
Factory Workers	37	43	15	1	2	2	100
Retirees	64	22	12	0	1	1	100
Farmers	67	17	8	0	8	0	100
Businessmen	54	25	5	7	2	7	100
Housewives	40	36	21	0	3	0	100
Professionals	67	14	10	0	0	9	100
Other	39	15	15	8	0	23	100
All Occupations	52	29	12	1	3	3	100

Source: Survey by the Mississippi State University Forestry Department.

he combination of planting, thinning and fencing).

"Professionals" had the highest ercentage (29%) with the highest ndex (Table 19) and only 5% of 'factory workers" performed nanagement practices at the ighest level. Only 11% of all espondents performed management practices at the highest level. 'Professionals" also had the ighest average levels of management, "housewives" the lowest "other" occupation category excluded).

Higher levels of educational ttainment tend to be associated vith higher levels of management ctivity (Table 20). However, lightly less than 5% of the owners vho performed no management ractices had completed college vhile about one fifth of those wners who practiced management at the highest level were ollege graduates.

The association of levels of nanagement with size of holdings howed no consistent pattern. Average size of the ownerships vith a management index level of 6-10 was smaller than that of wnerships with lower management indices. However, average ize of the ownerships with the ighest level of management activity ranged from two to three imes that of ownerships with ower levels of management. Also, wnerships with the highest levels f management accounted for 21% f the total forest acreage (Table 21).

Table 18. Management Practices Performed, Private Nonindustrial Owners of 20 to 500 Acres Forest Land, by Management Practice, Mississippi.

Practice	Percent of Owners[1]
Planting	22
Timber Stand Improvement	29
Thinning	24
Firelanes	10
Fencing Out Stock	9
Prescribed Burning	3
No Practice Performed	40

[1]Percentages do not add up to 100 because some owners performed more than one forest management practice.
Source: Survey by the Mississippi State University Forestry Department.

Table 19. Management Practices Indices, Private Nonindustrial Owners of 20 to 500 Acres Forest Land, by Occupation of Owners, Mississippi.

	Management Practices Indices[1]				
Occupation	0	1-5	6-10	11	Mean Index
	Percent				
Factory Workers	40	36	19	5	3.2
Retirees	46	3	12	11	4.35
Farmers	48	30	9	13	3.1
Businessmen	43	20	18	18	4.3
Housewives	55	24	15	6	2.7
Professional	14	43	14	29	5.9
Other	69	8	15	7	2.4
All Occupations	44	30	15	11	3.4

[1]Indices for each occupation category ranged from 0 = no management practice to 11 for the highest levels of management activity, such as the combination of planting, thinning and fencing.
Source: Survey by the Mississippi State University Forestry Department.

Private nonindustrial owners of forest land appear to be relatively knowledgeable about the various landowner assistance programs. However, participation by owners ranged from a low of 2% in the services offered by private consultants and wood-using firms to a high of only 34% in the programs of the Mississippi Forestry Commission (Table 22).

Owner attitudes toward timber management

The Forest Productivity Committee of the Mississippi Forestry Association surveyed 590 private nonindustrial forest owners in 1977 and the results provide valuable insights into the attitudes of owners toward timber management. However, the results likely are more representative of attitudes of owners of larger tracts because of differences in the number of usable questionnaires returned for ownerships of different sizes---sizes of ownership, numbers of questionnaires returned and representation of that ownership in the total sample as a percent were, respectively, under 50 acres, 59 and 10%; 51-100 acres, 112 and 19%; 101-200 acres, 133 and 23%; and over 200 acres, 286 and 48%.

Forty three percent of the respondents had planted trees on some forest land in the previous five years. However, only 22% of the owners with less than 50 acres had planted any trees in that period. Numbers of acres planted ranged from 1 to 3,000 but plantings of 20 to 30 acres were most prevalent.

Almost one half of the respondents reported the performance of some cultural practices in the previous five years. Over 100 of the owners practiced timber stand improvement. However, performance of timber stand improvement practices was reported much less frequently by the smaller owners. Thinning and timber stand improvement (e.g., by removing undesirable hardwood species) were the most common cultural practices.

Many respondents who had harvested no trees in the previous five years were owners of less than

Table 20. Management Practices Indices, Private Nonindustrial Owners of 20 to 500 Acres Forest Land, by Level of Educational Attainment of Owners, Mississippi.

Management Practices Indices[1]	Education of Owners, Years				Average Educational Attainment
	8	8-11	12-15	16	
	--------Percent--------				years
0	31.6	32.2	30.4	4.7	10
1-5	19.3	31.1	38.7	10.1	11
6-10	6.8	27.1	54.2	10.2	13
11	22.0	26.8	29.3	19.5	12
All Owners	23.1	30.5	36.4	8.7	11

[1]See Footnote 1, Table 19.

Source: Survey by the Mississippi State University Forestry Department.

Table 21. Average and Total Acreage, with Comparisons, Private Nonindustrial Owners of 20 to 500 Acres of Forest Land, by Management Practices Indices, Mississippi.

Management Practices Indices[1]	Acreage		
	Average	Total	% of Total
0	58	3,702,000	37
1-5	69	3,064,900	31
6-10	47	1,035,100	11
11	138	2,112,000	21
All Owners	83	9,914,000	100

[1]See Footnote 1, Table 19.

Source: Survey by the Mississippi State University Forestry Department.

Table 22. Knowledge of and Participation in Landowner Assistance Programs, Private Nonindustrial Owners of 20 to 500 Acres of Forest Land, by Agency or Program, Mississippi.

Agencies or Programs	Knowledge of Agency or Program	Used Agency or Program
Mississippi Forestry Commission	87	34
County Agents	88	22
Extension Foresters	51	3
Soil Conservation Service	83	29
Federal Assistance Programs (ACP, REAP, ASCS)	58	16
U.S. Forest Service - Y.L.T.	65	13
Tree Farm Program	67	14
Soil Bank (Federal Program)	71	6
Wood Using Firms	50	2
Consulting Firms (Fee basis)	37	2

Source: Survey by the Mississippi State University Forestry Department.

Table 23. Forest Acres Burned and Number of Forest Fires Suppressed by the Mississippi Forestry Commission, Selected Years.

Date	Acres Burned	Number of Fires
1970-71	54,779	4,995
1971-72	35,142	3,836
1972-73	32,136	3,525
1973-74	33,532	3,273
1974-75	41,926	3,400
1975 (Calendar year)	40,169	3,210

Source: Mississippi Forestry Commission

acres and 29% of the owners in
is size group do not plan any
rvest in the foreseeable future.
owever, 60% of all who responded
d harvested trees in the previous
e years and 40 acres was the
ost frequent size of the harvested
ea.

Partial cutting was preferred
ree-to-one over clear cutting---
rtial harvesting of stands ap-
rently is more compatible with
e multiple goals of owners of
iall forests (Porterfield and
oak, 1977). A major concern with
rtial harvesting is that inade-
ate consideration is given to
and regeneration. The pine in mixed stands frequently is harvested and the less desirable hardwoods are left on sites. Professional forestry advice generally is needed to assure protection and perpetuation of the pine component of stands.

Many respondents expressed concern with the desirability of performing timber management practices in the future. Some consider forest management too complex. Also, the low profitability associated with growing softwood or hardwood stumpage (Porterfield and Moak, 1977 and Porterfield and others, 1977) hinders more intensive forest management in some cases. However, the most frequently expressed causes of less intensive management were dislike of the damage resulting from harvesting and the inclination of many owners to save their timber and forest land for their heirs.

The negative reaction to harvesting is a concern of the Mississippi forest industry. However, opportunities exist for reducing the undesirable visual and physical impact of harvesting. Also, most forest land retained for descendants eventually will be available for harvest as timber matures (Turner, et al, 1977).

ississippi Forestry ommission programs[6]

The Mississippi Forestry Com-
ission (MFC) was established by
gislative act in 1926. The primary
rpose of the Commission is to
ovide service to Mississippi
sidents, particularly the private
nindustrial forest owners.

re prevention---The initial priori-
of MFC was protection of forest
nd from wildfire. This continues
a major concern; however, MFC
ograms now are concentrated
ore on fire prevention activities
d forest management practices
reduce the need for fire suppres-
on.

The forest area burned annually by wildfire has been reduced from an estimated 10 million acres in 1926 to less than 40,000 acres in

Table 24. Miles of Firelanes Constructed by the Mississippi Forestry Commission and Number of Owners Receiving the Service, Selected Years.

Date	Miles of Firelanes	Number owners
1970-71	2,174	2,012
1971-72	2,937	2,751
1972-73	2,697	2,460
1973-74	2,665	2,305
1974-75	2,023	1,689
1975-76	1,537	1,394

Source: Mississippi Forestry Commission

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[6] *Compiled from Annual Reports, Mississippi Forestry Commission and from information obtained from e State Forester's Office, Jackson, Miss.*

1975. Numbers of fires also have declined over time and only 3,210 fires were suppressed by MFC in 1975 (Table 23).

The major fire prevention efforts of MFC are firelane construction, prescribed burning and the Rur Community Fires Protecti Program. Firelane construction a service provided landowners o fee basis. More than 1,500 miles firelanes were constructed for 13 landowners in 1975-76 (Table 2 Prescribed burning of fore reduces ground debris so that le damage results if wildfire occu and also is used to control u desirable species in forest stan Use of this service by owne peaked in 1971-72 and only 22,5 acres were burned for 569 owners 1975-76 (Table 25).

Federal Cost Share money w made available for the Rural Co munity Fires Protection Progra in Fiscal 1974-75. This progra enables rural communities organize and equip rural f departments.

Resource management---The M sissippi Forestry Commissi provides technical advice a assistance on multiple-u management to (1) private for owners and operators, (processors of primary and sec dary forest products, and (3) pub lands agencies. The resou management services offered a timber marking, developi management plans, reco naissance and general assista (Table 26).

The Federal Incentives Progra (FIP) was created in 1973 to provi cost-share funds to private non dustrial forest landowners a responsibility for the techni assistance provided by t program was delegated to MF Most applicants for assistance c be reimbursed for 75% of exp ditures for such services as s preparation, tree planting seeding, and timber stand impro ment. Numbers of applicatio were larger in 1975-76 than in 19 75; however, the acreage for whi assistance was requested and co share funds approved were lov (Table 27).

Table 25. Acres of Prescribed Burning by the Mississippi Forestry Commission and Number of Owners Receiving the Service, Selected Years.

Date	Acres Burned	Number of Owners
1970-71	23,496	388
1971-72	43,160	875
1972-73	43,143	874
1973-74	38,694	801
1974-75	27,213	716
1975-76	22,538	569

Source: Mississippi Forestry Commission

Table 26. Record of Management Assistance Provided by the Mississippi Forestry Commission, by Service Provided, Selected Years.

Item	1972-73	1973-74	1974-75
General Assists (cases)	19,560	20,115	24,126
Reconnaissance or Diagnosis Cruise (cases)	9,946	9,577	9,697
Management plans:			
Number	946	1,133	1,386
Acres	121,071	125,729	138,103
Timber Marked			
MBF	41,884	38,146	16,306
Cords	47,913	63,224	31,367

Source: Mississippi Forestry Commission

Table 27. Number of Applications, Acreage of Forest Land Improved and Funds Approved, Federal Incentives Program, Mississippi, 1974-75 and 1975-76.

	Year	
Item	1974-75	1975-76
Applications (number)	739	868
Planted or Seeded (acres)	5,882	5,796
Improved by Release or Site Preparation for Natural Regeneration (acres)	4,139	2,100
Cost Share Approved for Above Work (dollars)	414,807	372,265

Source: Mississippi Forestry Commission.

Table 28. Numbers of Applications, Acreage of Forest Land Improved and Funds Approved for Programs Authorized by the Mississippi Forest Resources Development Act, 1974-75 and 1975-76.

Item	Year 1974-75	Year 1975-76
Applications (number)	546	827
Planted or Seeded (acres)	9,720	10,301
Released or Site Prepared for Natural Regeneration (acres)	5,119	5,606
Cost Share Approved for Above Work (dollars)	614,616	621,927

Source: Mississippi Forestry Commission

The Forest Resource Development Act passed by the Mississippi Legislature in 1974 authorized cost-share funds for assisting private nonindustrial forest owners in tree planting, direct seeding, and other forest improvement practices. This program is similar to the FIP program and is administered by the MFC. The State program is financed by revenue from the timber severance tax. Numbers of applications, the acreage for which assistance was requested and cost-share funds approved were larger in 1975-76 than in 1974-75 (Table 28).

Sufficient time has elapsed for the Federal and State incentive programs to become fully operative ---forest owners generally are more aware of their opportunities and the public agencies involved have adjusted to providing administrative support and technical assistance. Therefore, the acreage for which assistance was requested and cost-share funds approved under both programs increased substantially in 1976-77 (Table 29).

Summary of services: 1. Protection from wildfire; the landowner pays 2 cents/acre/year tax for this service.

2. Preparation of forest resource management plans; there is no charge to the landowner for this service.

3. Marking timber for sale; up to 40 acres annually per ownership is free of charge.

4. Marketing assistance; the landowner is furnished sample sale contracts and information on prospective buyers. There is no charge to landowners.

5. Growing tree seedlings in MFC nurseries for sale to landowners at cost; prices are quoted each year.

6. Tree planting; a fee is charged when the MFC performs the service. A list of private vendors who perform the service is furnished landowners.

7. Release of desirable seedlings (TSI); a fee is charged when performed by MFC. A list of private vendors who perform the service is furnished landowners.

8. Mechanical site preparation; a list of private contractors (vendors)

Table 29. Funds Approved Under the State Forest Resource Development Program (FRDP) and the Federal Incentives Program (FIP), Mississippi, 1976-77.

Practice	FRDP Acres	FRDP Cost-Share	FIP Acres	FIP Cost-Share
	No.	$	No.	$
Site Preparation (For Planting)	18,442	497,273	10,724	396,542
Planting	16,970	442,970	16,521	441,118
Release	6,232	106,929	3,336	75,866
Site Preparation (For Regeneration)	677	9,852	1,020	20,403
TOTAL	42,321	1,057,024	31,601	933,929
Fire Breaks	Linear Feet	Cost-Share	Linear Feet	Cost-Share
	111,890	$2,259	89,670	$2,242

Source: Mississippi Forestry Commission

is provided.

9. Firelane construction; a fee is charged when service is preformed by MFC.

10. Prescribed burning; a fee is charged when performed by MFC.

11. Incentives programs, both FIP and FRDP; resource management plans are prepared free of charge along with information about the programs. Individual forest management activities are performed in connection with these programs.

12. Insect and disease control; the MFC provides technical personnel to examine and identify th causal agent and recommend treatment without charge.

13. Assistance to urban owners the MFC provides advice on tre care and recommends treatment.

MISSISSIPPI'S FOREST INDUSTRY

Mississippi's forest industry firms are well distributed over the State (Figure 2) and serve as the basis of forestry's contribution to the Mississippi economy. Forestry is a primary manufacturing industry and many secondary and service jobs depend on forestry-related employment. This dependency is true statewide but is even more important at the loca level where forestry employmen may be critical to economi maintenance or growth, particularly in the small rural communities

Employment and earnings

Employment---Forestry employment of individuals covered by the Mississippi Employment Security Law totaled 39,940 in 1975---37,937 working for forest industry firms (Table 30) and 2,003 working for self-employed individuals and firms engaged in harvesting sawtimber and pulpwood. Additionally, 4,960 full-time self-employed individuals and unpaid members of their families not covered by Mississippi Employment Security Law worked as timber harvesters (1,570 in sawtimber harvesting and 3,336 in pulpwood). Therefore, employment in the Mississipp forest industry totaled 44,846 ir 1975.

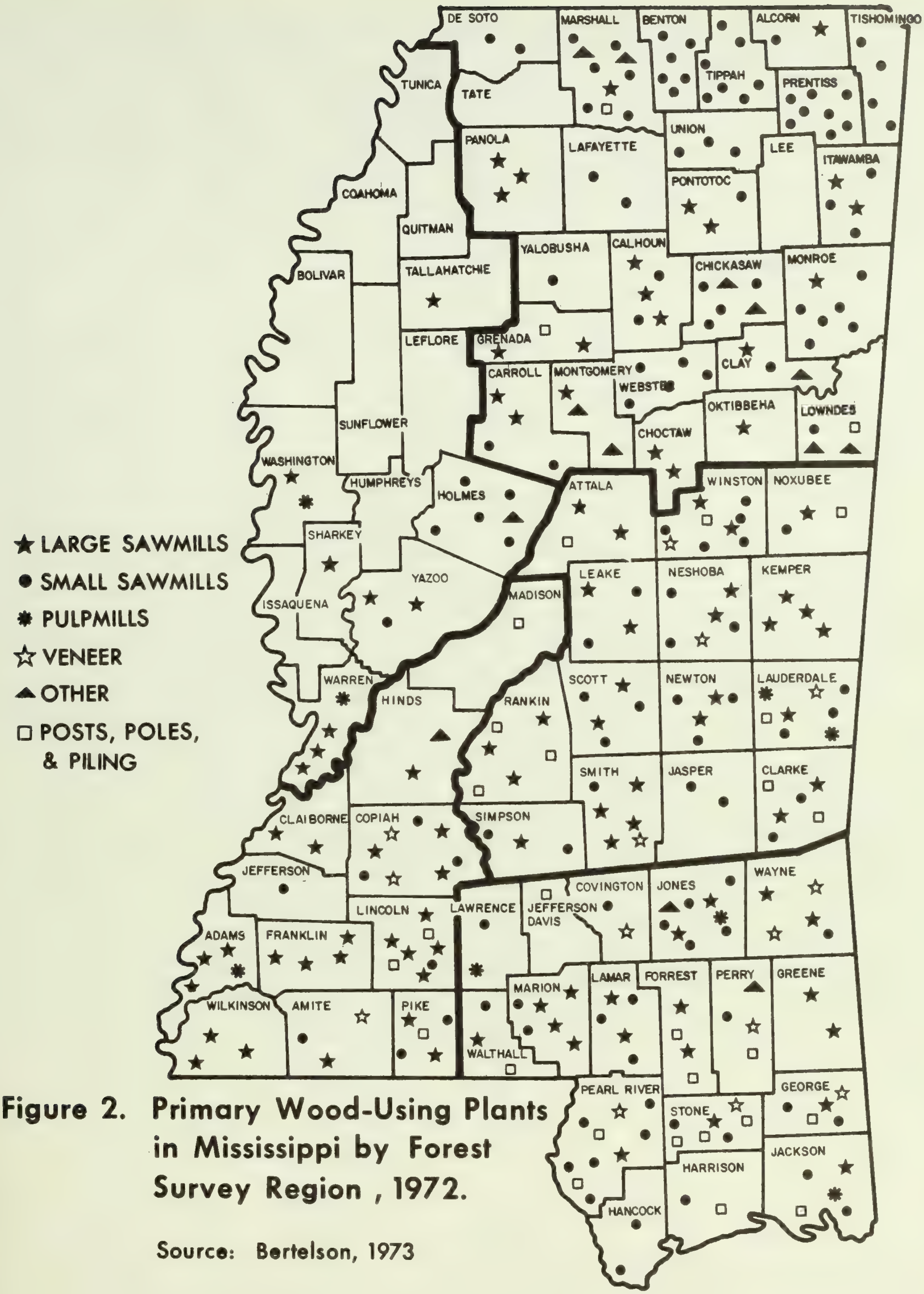
Employment in forest management is much larger in the Southwest forest survey region than in other regions (Table 30 because of the large numbers o

Table 30. Employment by the Forest Industry, by U.S. Forest Service Survey Region and Type of Industry, Mississippi, 1975.

Industry	North	Delta	Southwest	Central	South	Total[1]
	Survey Region					
	---Number---					
Forest Management	179	93	635	167	338	1,675
Logging Camps and Contractors	316	90	562	451	547	2,003
Sawmills, Plywood and Millwork	4,643	2,323	3,220	3,951	4,450	18,664
Wood Furniture and Fixtures	953	163	1,934	([2])	561	3,618
Paper and Allied Products	436	415	2,241	428	2,730	6,350
Total	6,527	3,084	8,592	4,997	8,626	32,310
Upholstered Wood Furniture	6,919	(-----------all other regions = 711------------)				7,630
			Forest Industry Total			39,940

[1] Includes any unclassified as to district and any failing to meet disclosure criteria.

[2] Negligible



★ LARGE SAWMILLS
● SMALL SAWMILLS
✱ PULPMILLS
☆ VENEER
▲ OTHER
□ POSTS, POLES, & PILING
DE SOTO
MARSHALL
BENTON
ALCORN
TISHOMINGO
TUNICA
TATE
TIPPAH
PRENTISS
UNION
PANOLA
LAFAYETTE
LEE
ITAWAMBA
COAHOMA
PONTOTOC
QUITMAN
YALOBUSHA
CALHOUN
CHICKASAW
MONROE
BOLIVAR
TALLAHATCHIE
LEFLORE
GRENADA
CARROLL
MONTGOMERY
WEBSTER
CLAY
OKTIBBEHA
LOWNDES
SUNFLOWER
CHOCTAW
WASHINGTON
HUMPHREYS
HOLMES
ATTALA
WINSTON
NOXUBEE
SHARKEY
YAZOO
LEAKE
NESHOBA
KEMPER
ISSAQUENA
MADISON
WARREN
HINDS
RANKIN
SCOTT
NEWTON
LAUDERDALE
SMITH
JASPER
CLARKE
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
COVINGTON
JONES
WAYNE
LINCOLN
LAWRENCE
JEFFERSON DAVIS
ADAMS
FRANKLIN
MARION
LAMAR
FORREST
PERRY
GREENE
WILKINSON
AMITE
PIKE
WALTHALL
PEARL RIVER
STONE
GEORGE
HARRISON
JACKSON
HANCOCK

Figure 2. Primary Wood-Using Plants in Mississippi by Forest Survey Region, 1972.

Source: Bertelson, 1973

Table 31. Earnings by Forest Industry Employees, by U.S. Forest Service Survey Region and Typ of Industry, Mississippi, 1975.

Industry	North	Delta	Southwest	Central	South	Total[1]
	Survey Region					
	Thousands of dollars					
Forest Management	1,484	645	6,700	1,442	2,871	15,83
Logging Camps and Contractors	1,298	295	2,745	2,181	3,174	10,12
Sawmills, Plywood and Millwork	31,989	17,693	24,285	30,139	40,226	144,48
Wood Furniture and Fixtures	5,537	1,061	14,811	(2)	3,420	24,86
Paper and Allied Products	3,669	6,983	27,273	4,479	33,346	75,75
Total	$43,977	$26,677	$75,814	$38,241	$83,037	$271,06
Upholstered Wood Furniture	$51,412	(---------all other regions = $5,256---------)				$ 56,66
			Forestry Industry Total			$327,73

[1] Includes any unclassified as to district and any failing to meet disclosure criteria.
[2] Negligible

Table 32. Employment and Earnings of Forestry Industry Workers, with Comparisons, Mississippi 1975.

Industry	Employment		Earnings		Earnings Per Employee	
	No.	%	$1,000	%	$	%
Forest Management	1,675	---	15,836	---	9,455	--
Logging Camps and Contractors	2,003	---	10,126	---	5,056	--
Sawmills, Plywood Millwork	18,664	---	144,484	---	7,741	--
Wood Furniture and Fixtures	3,618	---	24,869	---	6,874	--
Paper and Allied Products	6,350	---	75,750	---	11,929	--
Upholstered Wood Furniture	7,630	---	56,668	---	7,427	--
TOTAL	39,940	---	327,733	---	8,206	--
All Manufacturing	202,092	19.8*	1,644,262	19.9*	8,136	101
All Non-Agriculture Wage and Salary Workers[1]	692,592	5.8*	5,559,323	5.9*	8,027	102
Agricultural Wage and Salary and Proprietors[2]	115,612	34.5*	469,042	69.9*	4,057	202

[1] U.S. Dept. of Commerce, *Employment and Earnings*
[2] Bureau of Economics Analysis Estimates
***Forestry total as % of each specified industry.**

Table 33. Distribution of Employees by Occupational Group and Industry and Educational Levels of Employees, by Occupational Group, Mississippi, 1970.[1]

Industry	Professional, Technical	Managers, Administrators	Sales Workers	Clerical Workers	Craftsmen	Machine Operators	Transport Equip. Operators	Laborers	Service Workers incl. Private Household	Farm Workers (self-employed and farm laborers)
	Percent									
MISSISSIPPI	12	8	6	13	14	17	5	6	14	6
Agriculture	3	.8	(2)	1	2	1	1	4	a	86
Mining	9	7	.7	5	19	47	7	3	1	
All Manufacturing	4	3	2	8	17	51	4	8	2	
Furniture, Lumber and Wood Prods.	2	4	a	6	18	38	7	22	2	
Paper and Allied Products	6	2	1	9	23	41	5	8	3	
Fabricated Metals Industry	4	3	1	8	25	50	3	4	2	
Food and Kindred Products	2	7	5	8	11	43	13	9	3	
Construction	5	8	(2)	4	56	5	5	16	1	
Entertainment and Recreation Services	19	20	5	9	7	.6	(2)	10	29	
Employees with at least a High School Education	91	75	69	84	44	36	28	21	53	22

Source: Adapted from table 180 and table 179 (percent of occupation group completing high school), Census of Population, characteristics of the population: Mississippi 1970. U.S. Dep. of Commer., Bur. Census, Washington, D.C.

[1] See Appendix A for composition of industry groups.

aLess than 1 percent.

Mississippi Forestry Commission and U. S. Forest Service employees at each agency's central office in Jackson. Employment in the paper and allied products sector is concentrated heavily in the Southwest and South regions. Employment in the manufacture of upholstered wood furniture is concentrated in the North.

Earnings---Earnings by "covered" employees in the Mississippi forest industry (excluding the 4,960 "not covered" employees engaged in harvesting sawtimber and pulpwood) totaled more than $327 million in 1975 (Table 31). The $83 million earnings in the South region where employment was highest were exceeded only by those in the North region, when the large numbers employed in the manufacture of upholstered wood products in the North are added in. Earnings in the South and Southwest regions reflect the importance of the paper and allied products sector.

Total employment bv the Mississippi forest industry in 1975 was 19.8% of the total employment in all manufacturing activities and earnings of forest industry employees were 19.9% of all manufacturing earnings (Table 32). Average earnings of forest industry employees were slightly higher than those of workers engaged in other manufacturing and were highest for employees of the paper and allied products sector of the forest industry. The average forestry worker earned more than twice that of the average agricultural worker.

Workforce characteristics

Occupation and education---More than 70% of the Mississippi forest industry workforce is drawn from three occupational groups---craftsmen, machine operators and laborers. Machine operators predominate, with 41% of employees in the paper and allied products sector and 38% of those in the furniture, lumber and wood products sector supplied from this group (Table 33). Craftsmen rank

Table 34. Age Distribution and Median Age of Mississippi Forest Industry Employees, wit Comparisons, 1970.[1]

Sector	Proportion of Work Force (years) 16-24	25-44	45+	Media Age
		(percent)		(years)
Mississippi	18	43	39	40
Agriculture	14	32	52	44
Mining	18	54	28	38
Construction	15	42	43	42
Forestry related				
Logging	17	50	33	39
Sawmills, Plywood, Etc.	14	40	46	42
Misc. Wood Products	14	42	44	42
Paper and Allied Prod.	18	53	29	38
Furniture and Fixtures	25	50	25	37
Fabricated Metals	23	53	29	39
Chemicals and Allied Prod.	27	39	34	38
Wholesale and Retail Trade	21	40	39	38
Entertainment and Recreation Services	24	33	43	40

[1]Adapted from Table 187, Census of Population, Characteristics of the Population: Mississippi 1970, U.S. Dept. Commer., Bur. Census Washington, D.C.

Table 35. Place of Residence of the Employed Work Force, by Industry, 1970.[1]

Sector	Percent Urban	Rural Nonfarm	Rural Farm
		%	
Mississippi	49	43	8
Agriculture	11	50	39
Mining	37	57	6
Construction	43	49	8
All Manufacturing	39	53	8
Furniture, Lumber & Wood Products	29	62	9
Fabricated Metals	42	51	7
Textile Mill, Apparel and Allied	27	62	11
Chemical and Allied	55	40	5
Motor Vehicles & Other Transportation Equipment	56	40	4
Wholesale Trade	62	33	5
Entertainment & Recreational	68	29	3
Elementary, Secondary and Colleges	57	36	7

[1]Adapted from table 55 of Census of Population, Characteristics of the Population: Mississippi 1970, U.S. Dept. of Commerce, Bureau of Census, Washington, D.C.

second in the paper and allied products sector and laborers rank second in the furniture, lumber and wood products sector.

Employees of the Mississippi forest industry are drawn heavily from occupational groups with lower educational levels. For example, only 21, 28, 36 and 44% of laborers, transport equipment operators, machine operators and craftsmen, respectively, had at least a high school education. These occupational groups accounted for 77 and 85% of t employees in the paper and alli products sector and the furnitu lumber and wood products sect respectively. The avera educational level of employees the paper and allied products sec

Table 36. Percentage of the Civilian Labor Force Working 50 Weeks or More and Relative Importance of Females and Minorities in the Work Force, by Industry, Mississippi, 1970.[1]

Sector	Employed Labor Force		
	Working 50 - 52 Wks.	Female	Negro and Spanish Speaking
	%		
MISSISSIPPI	63	39	29
Industry			
Agriculture	53	7	48
Mining	68	5	8
Construction	58	4	25
All Manufacturing	68	34	27
Forestry Related:			
Forestry	(2)	13	20
Logging	41	4	56
Sawmills, Millwork	65	7	53
Misc. Wood Products	74	15	36
Paper and Allied	78	12	23
Furniture and Fixtures	70	24	31
Fabricated Metals	76	14	28
Apparel and Other Fabricated Textiles	58	83	14
Chemicals and Allied	79	17	25
Wholesale and Retail Trade	69	38	18
Entertainment and Recreational	56	35	27
Professional and Related Services (Health, Education, Welfare Services, etc.)	53	68	33

[1]Adapted from tables 183, 184 and 185 of Census of Population, Characteristics of the Population: Mississippi, 1970, U.S. Department of Commerce, Bureau of Census, Washington, D.C.
(2) Unavailable

s higher because this sector draws nore employees from professional nd other more educated ocupational groups. Agriculture has he least well educated workforce.

Age and place of residence---The nedian age of forest industry mployees in 1970 differed only lightly from the 40-year median ge of all persons employed in the State, ranging from 37 in furniture nd fixtures to 42 in miscellaneous vood products and sawmills, lywood, etc. Age distribution of orest industry employees also did not differ greatly from that of all ersons employed in the State. Major exceptions were the relativey high percentage of younger ersons employed in furniture and ixtures and the smaller percenages of younger people employed n the two forest-related sectors vhere median age of employees vas highest (Table 34).

More than 70% of the Mississippi forest industry's employees reside in rural areas (Table 35). This adds emphasis to the contribution of forestry to the State's economy. Incomes of rural residents who work for the forest industry generally are spent in urban (trade) centers. Therefore, the entire economy benefits from forestry employment. Also, the only employment in manufacturing in many communities is that related to forestry activities.

Weeks worked and workforce composition---The percentage of the Mississippi labor force working 50 weeks or more in 1970 averaged 63 for all occupational categories and ranged from 41 for logging to 79 for the chemicals and allied category (Table 36). Except for the logging and sawmills-millwork categories, percentages of the workforce working 50 weeks or more were higher in forestry-related occupations than in all manufacturing. Employment in paper and allied product manufacturing appears especially stable.

Female employment in forestry-related activities ranged from only 4% of total employment in logging to only 15% in miscellaneous wood products. The State average for all occupations was 39%, and 34% of the employees in the all manufacturing category were female (Table 36).

The percentage of minorities in the workforce is higher in forest-related occupations than the State average for all industries and is higher in logging and sawmill-millwork than in other sectors of the forest industry (Table 36). Therefore, expansion of the forest industry can be expected to contribute significantly to minority employment.

Occupational hazards and costs of workmen's compensation

The lumber and timber products sector ranked second to general construction in number of work-related deaths in Mississippi in 1975. Forestry-related Workmen's Compensation claims and Workmen's Compensation payments led the State in 1975 (Table 37). Furniture and finish lumber products ranked ju behind lumber and timber produ in number of claims and to Workmen's Compensati payments. Numbers of claims forestry industry employees decl ed from 1972 to 1975 but to compensation payments increas (Table 38).

Table 37. Deaths, Workmen's Compensation Claims and Workmen's Compensation Payments Resulting From Work-Related Injuries, Mississippi, 1975.

Sector	Deaths	Cases	Total Cost
	---------Number---------		$
MISSISSIPPI	139	10,636	21,198,147
General Farms	0	34	62,615
Forestry	1	20	.38,463
General Construction	20	1,163	2,916,138
Food and Kindred	6	700	927,576
Apparel and Other Textiles	1	370	550,727
Lumber and Timber Prod.	11	774	1,622,704
Furniture and Finished Lumber Products	2	727	1,134,097
Paper and Allied	2	139	217,463
Printing and Publishing	1	24	48,304
Chemical and Allied	2	343	609,415
Stone, Clay and Glass	7	365	649,825

Source: Preliminary Draft of the Twenty-Seventh Annual Report of the Mississippi Workmen's Compensation Commission, Jackson, MS

Table 38. Number of Workmen's Compensation Cases and Workmen's Compensation Payments, Forest Industry, By Sector, Mississippi, 1972-1975.

Sector	1972	1973	1974	1975
	Year			
Lumber and Timber Basic Products				
Cases (Number)	842	829	923	774
Total Payments ($1,000)	1,011	1,131	1,461	1,622
Paper and Allied Products				
Cases (Number)	127	130	137	123
Total Payments ($1,000)	178	245	257	217

Source: Preliminary Draft of the Twenty-Seventh Annual Report of the Mississippi Workmen's Compensation Commission, Jackson, MS

Compensation for work injur in Mississippi is paid by employ through the Mississip Workmen's Compensati program. Each firm in an indust pays a basic rate per $100 payroll. The rate depends up each industry's payments workers injured while on the j and is a good general index safety conditions in each indust Logging and lumbering (pulpwo only, including drivers) had t highest rate in Mississippi in Ju 1977 and the increase since Octol 1975 was greater than for any otl occupation (Table 39).

Available data not reported h indicate that forestry employme in Mississippi is significantly le hazardous than is typical of t entire U.S. forestry indust However, forest industry empl ment generally is more hazardo than most employment alt natives in Mississippi and this reflected in significantly high costs for forest industry firms.

Capital investment

The combined capital expe diture of all sectors of the Mississi pi forest industry has exceeded th of any other manufacturi industry in the State and h amounted to 25% or more of tot investment in Mississippi in mo recent years[7] (Table 40). Results a survey of Mississippi Forest

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[7] *The very large investment by the transportation equipment industry in 1970 moved investment in forest manufacturing to second place and capital expenditure by the forest industry amounted to only 15% of tot manufacturing investment that year.*

Table 39. Workmen's Compensation Rates in July 1977 and Change From October 1975 to July 1977, Selected Occupations, Mississippi.

Occupation	Rate Per $100 of Payroll	Change Oct. 1975 to July 1977
	$	%
Logging and Lumbering (pulpwood only, incl. drivers)	34.59	+42
Aircraft Operators - Public Exhibition	23.31	+18
Oil Well Rigging	20.64	+5
Window Cleaning Including Drivers	18.47	+16
Logging and Lumbering (sawtimber, N.O.C., incl. drivers)	14.78	+6
Sawmills	4.50	+3
Dairy Farms	4.07	-8
Veneer Manufacturing	3.68	0
Oil and Gas Lease Operators Incl. Drivers	3.00	+14
Police	2.91	+18
Planing or Moulding Mills	2.87	-9
Furniture Stock Manufacturers	2.39	+11
Clay Products Manufacturing	2.28	+5
Fireman	1.95	+15
Paper and Pulp Manufacturing	1.87	+11
Colleges and School Professors, Teachers, etc.	0.23	+15

Source: The Basic Manual of Rules, Classifications and Rates for Workmen's Compensation and Employer's Liability Insurance, 1934 (original printing), Rates effective October 1, 1975 and July 1, 1977. Office of the Insurance Commissioner, Jackson, MS

ssociation members indicate that he 1975 capital expenditures were llocated to pollution control (13%), ew plants and equipment (34%), nd maintenance and upkeep 53%). These expenditures repre- ent a tremendous investment in he future of Mississippi forestry.

Many forestry firms have financ- d their capital investments hrough the sale of BAWI (Balance griculture With Industry) bonds. orest industry investments inanced through the sale of BAWI onds were $77.7 million in lumber nd wood products, $13.6 million in wood furniture, and $21.1 million n paper and allied products from 971 through 1976.

The massive capital investments n recent years have steadily in- reased labor productivity in most ectors of the forest industry and the industry is now less labor intensive. However, the combined employment of production workers in all forest-related activity (lumber and wood products, sawmills and planing mill, millwork-plywood, furniture and fixtures, paper and allied products) still exceeds that of any other manufacturing industry in the State (Table 41).

Production workers in all sectors of the forestry industry work more 40-hour weeks per year than those in the industry that ranks second in number of production workers (apparel, other textile) and average annual wages per worker are higher (Table 41). The forest industry also is less labor intensive---wages of production workers as a percentage of total payroll, cost of materials and capital investment are higher in apparel and other textiles than in any sector of the forest industry.

Average value added per hour worked by production employees in the forest industry increased from 83% of the average for all Mississippi industries in 1974 to 93% in 1975 (Table 42). Value added per hour worked in all forest-related activities other than paper and allied products was much lower than the average for all Mississippi industries in both years. Value added per hour worked in the paper and allied products sector was much higher than the State average for all industries.

Low value added per hour worked is typical of lumber and wood product mills throughout the United States (Figure 3). Net value added per hour worked (value

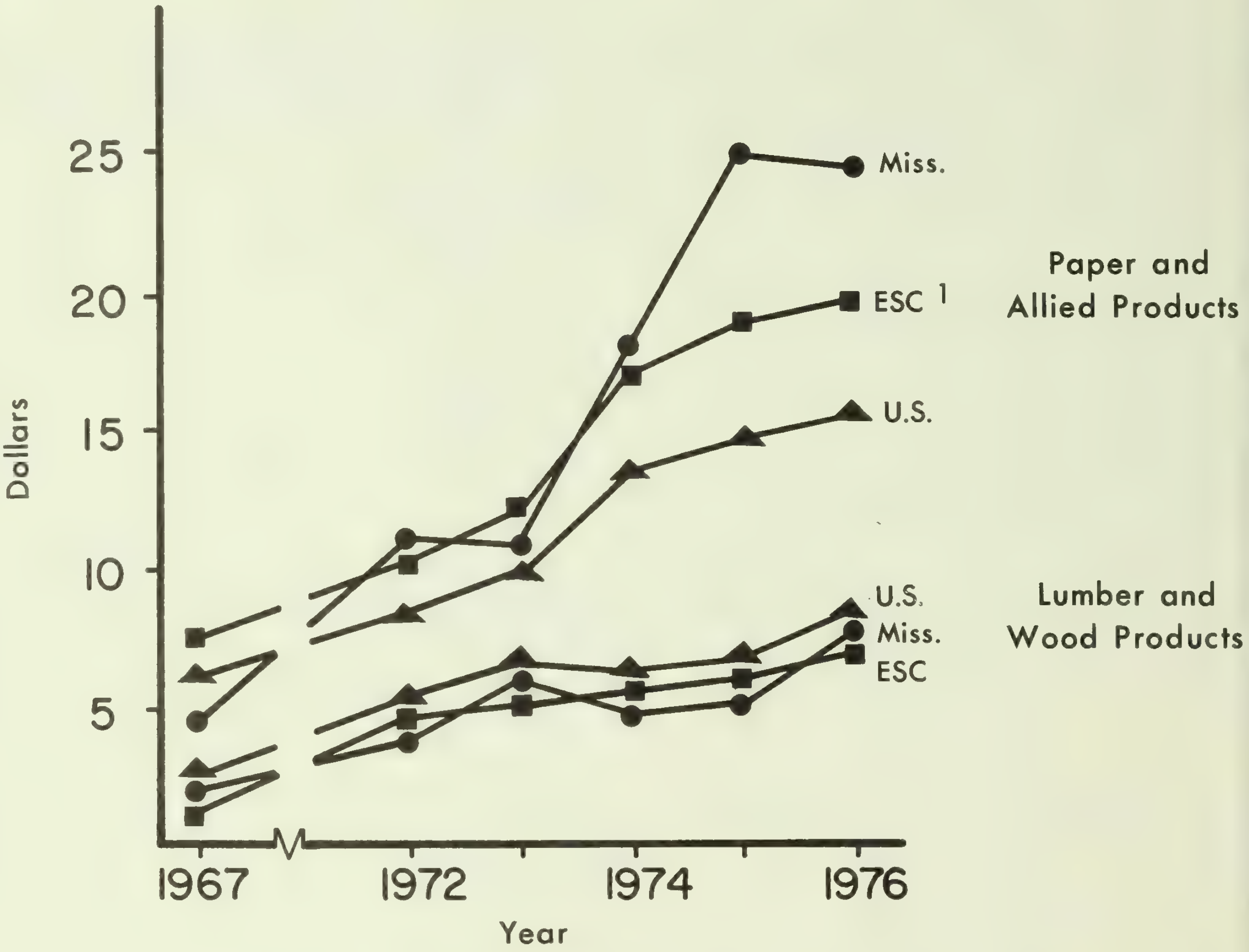

Figure 3. Net Value Added per Production Employee Hour for Paper and Allied Products and Lumber and Wood Products by Region

Source: Census of Manufacturers and Annual Survey of Manufacturers

[1] East South Central Region, Kentucky, Tennessee, Alabama and Mississippi

dded per production employee our minus wage per production mployee hour) in the paper and llied products sector of the orestry industry has increased ramatically in the United States, he East South Central region, and Iississippi in recent years. Iowever, gains have been greater n Mississippi and the State's aper industry is now far ahead of he Nation.

Factors contributing to the nassive increases in investment y the Mississippi forest industry re proximity to raw materials lower transportation costs), omewhat lower labor costs, and ery favorable employee attitudes nd work habits (Wangel, 1977). Such factors have provided Mis-issippi's paper and allied products ector an apparent comparative dvantage over other regions. Capital investments in high echnology equipment because of he favorable environment for xpansion in Mississippi have reatly increased net value added er production employee hour in aper and allied products.

Table 40. Capital Expenditures By Selected Industries, Mississippi, Selected Years.

Item	1968	1970	1972	1974	1975
	(million $)				
MISSISSIPPI	143.7	274.7	235.9	319.7	260.1
Industry					
Food and Kindred	4.1	11.8	19.2	23.6	22.7
Apparel, Other Textile	3.0	5.6	8.1	10.1	11.6
Lumber and Wood Products	20.4	29.9	43.6	61.7	38.5
Sawmills and Planing Mills	(u)	7.9	11.3	20.4	11.1
Millwork, Plywood, Etc.	(u)	(d)	6.7	8.7	3.3
Furniture and Fixtures	2.3	4.1	11.4	10.3	5.0
Paper and Allied Products	25.6	7.0	6.4	22.1	21.9
Chemicals and Allied	19.3	15.2	15.8	43.4	23.7
Machinery, Except Elect.	5.4	6.5	24.6	14.7	12.1
Electric Equip.	5.4	10.2	16.0	30.6	14.5
Transportation Equip.	5.3	75.9	19.9	24.2	23.6
Lumber and Wood Products, Paper and Allied, and Furniture and Fixtures, as a Percent of Mississippi Total	34%	15%	26%	29%	25%

(u) unavailable

(d) withheld because of disclosure criteria

[1] Source: Annual Survey of Manufactures and Census of Manufacturers

FORESTRY AS PART OF MISSISSIPPI'S OVERALL ECONOMY

Increased production efficiency n Mississippi's forest industry esults in a greater gross state roduct, higher household in-comes, and increased employment f the labor force. The direct con-ribution of the forest industry to he State's economy is important ut a more comprehensive measure f the industry's importance can be btained by considering the in-eractive effects of increased forest ndustry output among the in-erdependent sectors of the conomy. Each producing sector in n interdependent economy sells to nd buys from other producing ectors as each engages in its own roduction. Demand for output by ther producing sectors is termed *intermediate* demand. The remainder of each sector's production is sold to households, the Federal Government or is exported.

A major characteristic of the Mississippi forest industry is the large-scale in-state manufacture of raw materials purchased for the most part within the State. Some sectors of the industry sell primarily to other firms in Mississippi, others export the majority of their output. Each transaction stimulates the State's economy---larger purchases of raw materials put more dollars in the hands of forest owners, harvesting crews and haulers; sale of products to other firms in the State increases the circulation of dollars; and exports bring new dollars into the State.

Input-output analysis is a technique for simultaneous evaluation of the interaction of the interdependent sectors of an economy and for evaluating each sector as an integral part of an economy. The technique also provides a means of estimating economic changes generated by growth and development of individual industrial sectors. A common procedure in input-output analysis (after coefficients describing interdependencies are calculated) is to *assume* a given expansion in a sector as a means of describing that sector's importance within the economy.

Table 41. Number, Weeks Worked, Average Annual Wages, and Labor Productivity of Production Workers, by Industry, Mississippi.

Sector	Production Employees 1974	Production Employees 1975	40-Hr Work Week Equivalents (1975)	Wages per Production Worker 1974	Wages per Production Worker 1975	Wages of Production Worker as a % of Total Payroll, Cost of Materials, and Capital Invest. (1975)
	(1,000)		No.	-------$-------		%
MISSISSIPPI	169.3	157.2	47.4	6,338	7,155	15
Industry						
Food and Kindred	12.7	12.6	49.8	5,504	6,175	6
Apparel, Other Textile	35.2	32.5	43.1	4,480	4,769	29
Lumber and Wood Products	20.0	17.0	48.2	6,045	6,371	16
Sawmills and Planing Mills	8.0	6.9	48.9	5,550	6,116	20
Millwork Plywood	2.9	2.4	53.1	6,620	7,333	17
Furniture and Fixtures	12.8	11.0	46.8	5,680	6,309	23
Paper and Allied Prod.	5.1	4.6	50.5	10,373	11,717	16
Chemical and Allied	3.8	4.1	47.0	8,658	9,583	10
Machinery, Except Elect.	7.7	7.4	51.7	7,558	8,243	19
Electric Equipment	15.4	12.5	48.0	6,305	6,752	20
Transportation	17.7	22.0	48.5	8,028	9,732	21

Source: Annual Survey of Manufacturers, 1975, M75 (AS-6) U.S. Dept. of Commerce, Washington, D.C.

Table 42. Value Added, Total and Per Production Employee Hour, Mississippi, by Industry, with Comparisons, 1974 and 1975.

	Value Added			
	Total		Per Production Employee Hour	
	1974	1975	1974	1975
	--million $--		--------$--------	
MISSISSIPPI	3,785.9	3,685.5	11.71	12.36
Industry				
Food and Kindred	305.9	349.9	12.19	13.94
Apparel and Other Textiles	344.0	340.3	5.50	6.08
Lumber and Wood Products	307.5	261.5	7.67	7.97
Sawmills and Planing Mills	107.6	84.3	6.48	6.24
Millwork, Plywood, Etc.	42.7	49.6	7.12	9.73
Furniture and Fixtures	180.4	177.0	7.45	8.59
Paper and Allied Products	236.4	283.3	22.95	30.46
Chemical and Allied	338.5	347.2	45.13	45.09
Machinery, Except Elect.	204.3	208.6	12.93	13.63
Electrical Equipment	324.2	294.5	10.77	12.27
Transportation Equipment	458.3	430.5	14.23	10.08
Lumber and Wood Products, Paper and Allied and Furniture and Fixtures as a Percent of Mississippi Total	19%	20%	83%	93%

Source: Annual Survey of Manufacturers, 1975, M75 (AS-6). U.S. Department of Commerce, Washington, D.C.

Effect of forestry industry expansion on gross state product, household income and employment[8]

Assume that a sawmill-planing mill complex to be located in Mississippi will have annual sales of $7 million (a 2.5% increase in value of the total sawmill sector output) and that the mill will provide 70 new jobs. How would operation of the new mill impact on the Mississippi economy?

One half of all purchases by the sawmills and planing mills sector are in-state (Table 43); therefore, sales of $7 million by the new mill would be associated with an increase of $3.5 million in direct purchases from other Mississippi industries. Adding the indirect purchases by other industry sectors and the purchases induced by increased household spending brings the total increase in statewide economic output to $22.8 million.[9]

Table 43. In-State Sales and Purchases as a Percent of Gross Output, by Industrial Sector, Mississippi, 1974.

Sector	Sales	Purchases
	---------%	---------
Livestock and Agricultural Products	47	45
Food and Kindred Products	36	79
Mining	73	47
Construction	31	58
Textiles and Apparel	59	66
Misc. Primary Forest Products & Fisheries	78	31
Logging Camps & Contractors	100	53
Sawmills and Planing Mills	59	50
Millwork and Plywood	58	53
Wood Containers	34	52
Wood Buildings and Mobile Homes	19	71
Misc. Wood Products	21	61
Wood Furniture	37	58
Pulp, Paper and Board Mills	36	60
Paperboard Containers & Boxes	92	65
Printing and Publishing	59	47
Other Manufacturing	78	46
Transportation	71	39
Communications & Utilities	67	46
Wholesale & Retail Trade	36	16
Finance, Insurance, Real Estate	26	33
Services	37	11
State and Local Government	6	38

Employment and household i come effects of the new sawm also would be substantial. N jobs created by the new mill wou total 250 (70 in the sawmill plus 1 created in other sectors as a resu of operating the sawmill).[10] Als the $7 million in sales generated the new mill would result in $1. million of additional dire income paid to Mississip households. The multiplier effe would bring the total increase household income to more tha $5.6 million.[11]

A concise comparison of t contribution of each forestry sect and of all other producing secto to increases in total output, emplo ment and household income Mississippi can be made by refe ing to Table 44. Realizing t potential output, employment a household income gains from i creasing forestry output, as f other industrial sectors, requir an increase in final demand (sale for products. Further, becau there must be a stimulous for t original $100,000 output increas the best opportunities for outp increases in Mississippi cent upon products with strong dema outside the Mississippi econom Increases in out-of-state dema are therefore critical to futu increases in forestry output Mississippi because of the hi proportions of exports from some the more important sectors of t State's forestry industry.

THE FUTURE OF MISSISSIPPI FORESTRY

An assessment of the Nation's renewable resources completed by the U.S. Forest Service in June 1977 (U.S. Forest Service, 1977) indicates that the U.S. demand f all forest resources has been ar

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[8] *Based on the input-output model presented in Appendix B.*

[9] *Estimate based on the average of Type I and Type II output multipliers. See Appendix B, Table 2.*

[10] *Estimate based on the average of Type I and Type II employment multipliers. See Appendix B, Table*

[11] *Estimate based on the average of Type I and Type II income multipliers. See Appendix B, Table 4.*

Table 44. Economic Impact of a $100,000 Output Increase, by Economic Sector, Mississippi, 1974.

Sector	Output Increases in that Sector	Statewide Response		
		In Output	In Employment	In Household Income
Livestock & Agricultural Products	$100,000	$385,000	16	$122,000
Food & Kindred Products	100,000	447,000	14	112,000
Mining	100,000	378,000	9	115,000
Construction	100,000	402,000	12	112,000
Textiles & Apparel	100,000	453,000	19	120,000
Misc. Primary Forest Products & Fisheries	100,000	363,000	10	125,000
Logging Camps & Logging Contractors	100,000	332,000	18	83,000
Sawmills & Planing Mills	100,000	326,000	11	80,000
Millwork & Plywood	100,000	334,000	11	83,000
Wood Containers	100,000	369,000	13	106,000
Wood Buildings & Mobile Homes	100,000	408,000	12	101,000
Misc. Wood Products	100,000	376,000	13	97,000
Wood Furniture	100,000	364,000	15	93,000
Pulp, Pap. & Bd. Mills: Misc. Pap. Prod.	100,000	365,000	11	90,000
Paperboard Containers & Boxes	100,000	375,000	11	91,000
TOTAL FOREST INDUSTRY	100,000	356,000	12	90,000
Printing & Publishing	100,000	375,000	14	112,000
Chem. & Allied; Petroleum & Other Mfg.	100,000	412,000	11	105,000
Transportation	100,000	347,000	12	107,000
Communications & Utilities	100,000	356,000	13	107,000
Wholesale & Retail Trade	100,000	328,000	13	124,000
Finance, Ins., & Real Estate	100,000	353,000	11	120,000
Services	100,000	376,000	15	147,000
State & Local Government	100,000	355,000	18	110,000

till is increasing as a result of opulation increases, rising family ncomes and more leisure time Table 45). Appreciable increases n demand for forest resources also re projected in other reports (U.S. orest Service, 1973 and Bureau of utdoor Recreation, 1973).

The Nation's energy needs may ncrease the demand for timber ell beyond these projected levels, ecause the projected increases do ot account for the possible effect f the changing energy situation on the demand for forest resources. Wood can be burned, converted to charcoal and combustible gasses, used as the basis for manufacturing plastics and other petroleum-based products, and used in other ways to reduce dependency upon oil imports. Production of energy by plantations of fast-growing tree species to provide fuel for electricity generation has been shown to be promising (Howlett and Gamache, 1977).

Opportunities for increasing Mississippi's share in supplying the projected increases in demand for forest resources appear excellent. Upward population trends in Mississippi and the Southeast and stable or declining populations in the Northeast and Midwest mean that a larger percentage of the U.S. population will be in a position to use the recreational resources of Mississippi forests more readily. These population changes also place Mississippi closer to expanding markets for wood products.

United States trade in wood products (exports and imports) was 36% of domestic production in 1976, and international trade of wood products is projected to increase (Stone and Dickerhoof, 1977). World demand for paper and paper products (products for which Mississippi has a comparative advantage) is predicted to rise steeply (Stone and Saeman, 1977). M sissippi's ports provide an opp tunity for gaining an increasi share of the growing world mark for wood and wood products.

However, the U.S. Forest Servi assessment of renewable resourc also indicates that projected leve of demand are above those that ca be supplied with present manag ment of the Nation's forests. M sissippi has the forest lands an adequate labor resources in t occupational groups most need for expanding production b timber production is far belo potential. Methods of increasi the productivity of forests a known but largely unused at pr sent. Therefore, application more intensive forestry manag ment practices would ensure M sissippi's ability to respond to t growing market opportunities.

Table 45. Projected Increases in Demand for Forest Products, United States.

Product	Base Year	Percentage increase (base year equals 100) 1980	2000	2020
Remote camping	1975	106	133	180
Birdwatching	1975	107	138	168
Small game hunting	1975	106	121	136
Freshwater fishing	1975	111	156	205
Forest-range grazing	1970	135	150	164
Timber	1970	131	173	219
Water (consumptive use)	1975	103	123	139

Source: U. S. Forest Service, 1977

Effect of alternative forest management strategies

Ratios of timber growth to timber harvest with current levels of management of Mississippi's forest lands (Case A) provide an opportunity for increasing timber harvest without decreasing the State's total timber inventory. The additional raw materials would result in a greater gross state product, higher household incomes and increased employment of the labor force. However, total timber harvest and the subsequent impact on the State's economy would be much greater with more intensive management of forest industry lands (Case B) and private nonindustrial forests (Case C).

Case A (status quo management)---Annual timber growth in Mississippi exceeds timber harvest by 33 million cu ft (23.2 million cu ft of softwood and 9.8 million cu ft of hardwood); therefore, annual harvest could be increased 33 million cu ft without reducing the State's timber inventory.

Using the forest industry mix depicted in the input-output analysis, this much additional raw material would result in an increased output of $65.3 million for the forest industry (at 1974 prices) and would add more than 2,000 jobs in forestry employment. Increasing timber harvest to just balance annual growth with no increase in forest management intensity would increase Mississippi's total economic output by $232.4 million, would create 9,400 new jobs (including the 2,000 in the forestry industry), and would lead to more than a $61.1 million increase in household incomes of Mississippians.[12]

The $65.3 million increase for the forest industry represents only a 5% increase over current output. The statewide output, employment and household income effects represent increases of only 0.8, 1.2 and 0.7%, respectively (Figure 4).

Case B (more intensive management of forestry industry lands) Average production of forest i dustry lands in Mississippi is on 60% of the potential of fully-stock natural stands. An additional million cu ft of timber (large softwood) would be available f harvest if all forest industry acr were producing at natural stan potential.

Harvesting and processing th much additional raw materi would result in an increased outp of $164 million for the forest i dustry and would add as many 5,060 jobs in forestry employmen Intensified management of fore industry lands and subseque expansion of forestry output cou increase Mississippi's tot economic output by $584 milli and could mean as many as 23,6 new jobs (including the 5,060 in t forest industry) and as much $152.2 in additional household i come.

The $164 million increase

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[12] *Estimates based on the average of Type I and Type II multipliers for the forest industry mix.*

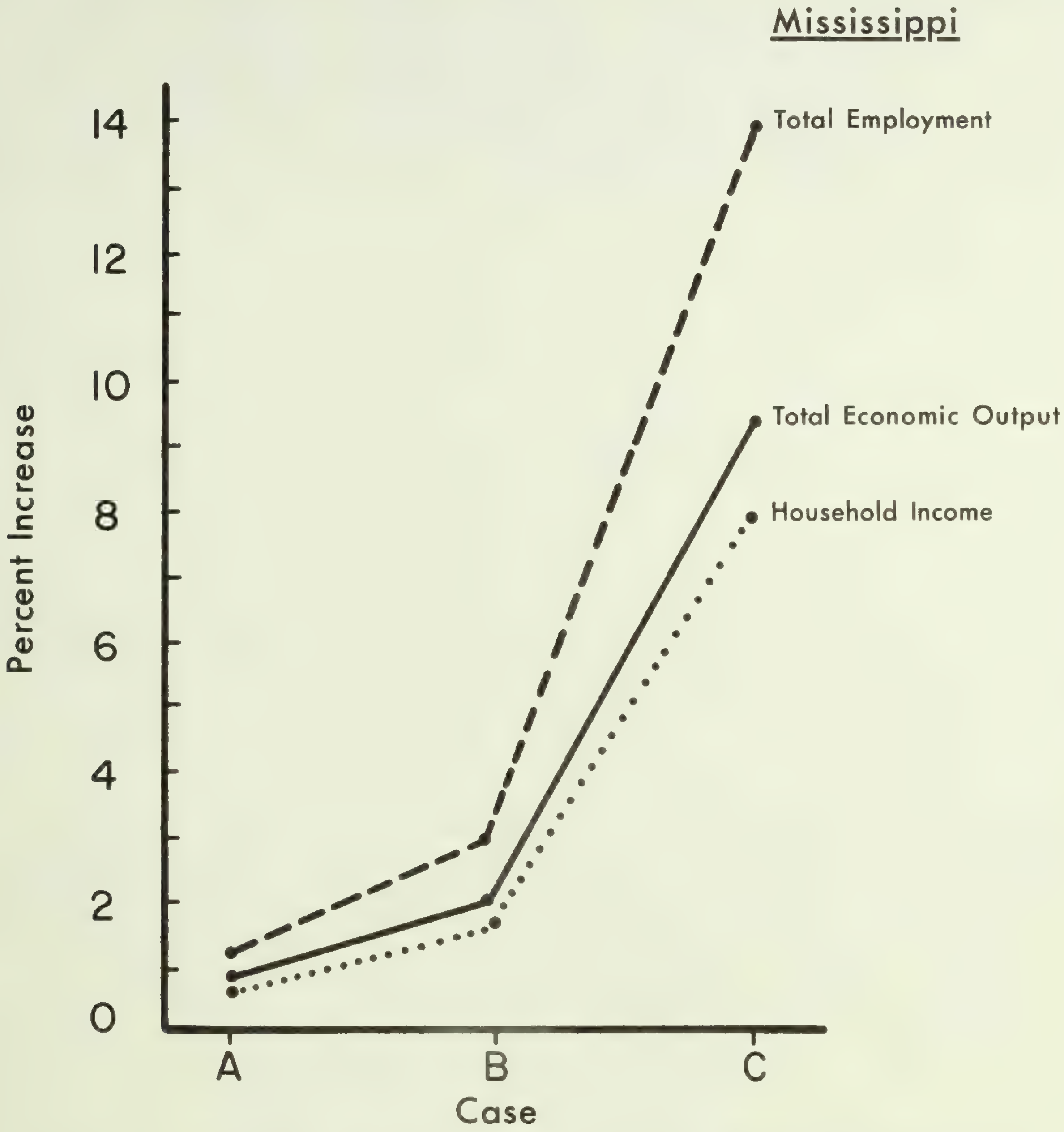

Figure 4. Impact of Expansion of the Mississippi Forest Products Industry

orestry output and the 5,060 new bs in forestry each represent an crease of 12% over current levels. he statewide output, employment nd household income effects re- resent increases of about 2.0, 3.0, nd 1.7%, respectively (Figure 4).

Case C (more intensive management of private, nonindustrial forest lands)---The largest opportunity for expanding forestry production lies in intensifying forest management of the private nonindustrial holdings that account for 75% of Mississippi's total forest acreage. Average production of forest lands in this ownership category is 49 cu ft of wood per acre per year, only 56% of average growth potential. Bringing productivity of the 12.5 million acres of land in this ownership category to the potential of fully-stocked natural stands would result in an additional 388.3 million cu ft of timber available for harvest.

Harvesting and processing this much additional raw material would result in an increased output of $767.8 million for the forest industry and would add as many as 23,686 jobs in forestry employment. Intensified management of the 12.5 million acres in the hands of private nonindustrial owners could increase Mississippi's total economic output by $2733.3 million and could mean as many as 110,600 new jobs (including the 23,686 in the forest industry) and as much as $717.2 million in additional household income.

The $767.8 million increase in forestry output and the 23,686 new jobs in forestry each represent an increase of about 60% over current levels. The statewide output, employment and household income effects represent increases of 9, 14 and 8%, respectively (Figure 4).

Caution in interpreting the impact of more intensive management of forest lands

The estimates of the impact of more intensive forest management (Cases B and C) are simple first approximations because input-output analysis or no other technique can estimate the impact of expansion of any large sector of an economy (especially a change of the magnitude of Case C) with complete accuracy. Also, the economic benefits attributable to more intensive management of the State's forest resources cannot be expected in the short run, because the forest industry and industries linked to it can bring about change of this magnitude only in the long run. Furthermore, a major limitation to bringing forest land productivity to the potential of fully-stocked natural stands is that many landowners will not be interested in intensifying management of their forest lands and some private nonindustrial ownerships are too small to permit profitable management and harvest.

Our estimates do indicate, however, the general magnitude of the benefits to be expected from more intensive management of Mississippi's forest resources. However, action programs to overcome three related impediments---low productivity, low profitability and low levels of owner's interest in forest resource management---will be required to realize the forest industry's potential contribution to the State's economy.

Action program elements

Intensifying forest management practices, particularly on the smaller private nonindustrial ownerships, is a complex matter. Any action program designed to promote more intensive management of such ownerships must fully recognize landowner's goals. Single-product management plans will be desired by some owners, but indications are that the majority will want multiple-product management plans. Tradeoffs between resources will have to be recognized for these multiple-product forest management plans and more research is needed in this area.

Action programs also must fully recognize the economics of timber production, which is a long-term activity with substantial risks. Production of timber with existing stand conditions is not profitable for many landowners and depleted stands may not contain an adequate number of acceptable growing stock trees to be managed for timber production even in conjunction with other forest resources. Most owners of small tracts do not have the financial resources for preparing land for planting; therefore, there is genuine danger that depleted stands will remain unproductive. Federal and state incentive programs, as well as industrial landowner assistance programs, offer very important aid in these cases.

Low profitability also means that landowners likely will favor natural stand management to minimize costs even where stocking is adequate. It also means that output of nontimber resources can be quite important in determining the level of forest management selected, because increasing output of a highly-valued alternative may cost so little in terms of timber revenue foregone. The advice of a professional forester is quite important under prevailing conditions of low profitability.

A massive communications effort is needed to acquaint owners of forest lands with their alternatives. Most landowners do not realize the multiple-use potential of forest land and do not have the knowledge of forest management practices necessary for increasing the cash flow from their property. Landowners need to be made aware of such items as stumpage price trends, growth response to forest management practices, other factors that increase productivity and profitability, and sources of assistance in improving management of their forest lands. The most useful approach is communication on a one-to-one basis in rder to assess goals of individual andowners.

The benefits from increasing the roductivity of Mississippi's forest ands are obvious from this study. Iowever, the future supply of the array of forest resource products available in Mississippi depends upon how well we meet the challenges facing Mississippi forestry today. The issues of low productivity, low profitability and low levels of interest in forest resource management all are related. Action programs must be implemented soon to assure a bright future for Mississippi forestry.

Appendix A

Composition of Input-Output Model Sectors

Sector	Components
. Livestock and Agricultural Products	a. Crops
	b. Livestock
	c. Dairy Products
	d. Poultry and Eggs
. Food and Kindred Products (Processing)	a. Meat Products
	b. Dairy Products
	c. Grain
	d. Vegetables
	e. Beverages
	f. Bakery Products
. Mining	a. Iron Ore
	b. Minerals
	c. Crude Petroleum
	d. Gas
	e. Stone and Clay
. Construction	a. New Construction
	b. Maintenance and Repair Construction
. Textiles and Apparel	a. Yarn and Thread Mills
	b. Fabric Mills
	c. Apparel
	d. Miscellaneous Textiles
. Miscellaneous Primary Forest Products and Fisheries	a. Timber Tracts
	b. Forest Nurseries
	c. Tree Seed Gathering
	d. Pine Gum Extraction
	e. Forest Products Gathering
	f. Commercial Fishing
	g. Hunting and Trapping
. Logging Camps and Logging Contractors	a. Wood Raw Materials Harvesting
. Sawmills and Planing Mills	a. Rough Timber Sawing

	b. Hardwood Dimension and Flooring Mills c. Special Product Mills
9. Millwork and Plywood	a. Millwork b. Wood Kitchen Cabinets c. Hardwood Veneer and Plywood d. Softwood Veneer and Plywood e. Laminated Structural Members
10. Wood Containers	a. Nailed and Lock Corner Wood Boxes and Shook b. Wood Pallets and Skids c. Cooperage, Wood Boxes, and Crates
11. Wood Buildings and Mobile Homes	a. Prefabricated Wood Buildings and Components b. Mobile Homes: Recreational and Dwelling
12. Miscellaneous Wood Products	a. Poles, Posts, and Piling b. Particleboard
13. Wood Furniture	a. Wood Household Furniture, except Upholstered b. Wood Office Furniture c. Wood Television, Radio, Phonograph, and Sewing Machine Cabinets d. Wood Partitions, Shelving, and Fixtures
14. Pulp, Paper, and Boardmills; Miscellaneous Paper Products	a. Pulp Mills b. Paper Mills c. Paperboard Mills d. Converted Paper and Paperboard Products
15. Paperboard Containers and Boxes	a. Folding Paperboard Boxes b. Set-up Paperboard Boxes c. Corrugated and Solid Fiber Boxe d. Sanitary Food Containers e. Fiber Cans, Tubes, and Drums
16. Printing and Publishing	a. Newspapers and Periodicals b. Books c. Miscellaneous Publishing d. Commercial Printing e. Printing Service Industries
17. Chemical and Allied; Other Manufacturing	a. Industrial Chemicals b. Petroleum Refining

	c. Miscellaneous Furniture d. Rubber and Miscellaneous Plastic Products e. Leather and Leather Products f. Primary Metal Industries g. Stone, Clay, Glass, and Concrete Products h. Fabricated Metal Products i. Machinery j. Transportation Equipment k. Precision Instruments and Clocks l. Miscellaneous Manufacturing
18. Transportation	a. Railroads b. Motor Freight Transportation c. Water Transportation d. Air Transportation e. Pipeline Transportation
19. Communications and Utilities	a. Telephone and Telegraph Communication b. Radio and Television Broadcasting c. Electric, Gas, Water, and Sanitary Services
20. Wholesale and Retail Trade	a. Wholesale Trade b. Retail Trade
21. Finance, Insurance, and Real Estate	a. Banking and Other Credit Agencies b. Security and Commodity Brokers c. Insurance d. Real Estate
22. Services	a. Hotels, Motels, and Other Lodging b. Personal Services c. Business Services d. Automotive and Miscellaneous Repair Services e. Motion Pictures and Amusements f. Health Services g. Legal Services h. Educational Services i. Social Services j. Agricultural Services k. Forestry Services l. Miscellaneous Services
23. State and Local Government	a. State Governments b. County Governments c. Municipal Governments d. School Districts

Appendix B

The Input-Output Model

A 1974 input-output model emphasizing the forest products ndustry was developed for Mississippi with the assistance of the Mississippi Research and Development Center. Published output data and 1967 national coefficients were used in construction of the model and the model was adjusted to Mississippi conditions by use of questionnaire response data received from members of the Mississippi Forestry Association. Twenty three producing (endogenous) sectors and three nonproducing (exogenous) final demand sectors were included in the model (Table 1 of this Appendix).

Table 1. 1974 Mississippi Interindustry Transaction or Flow Matrix.[1]

Sector		Purchasing Sector Code*							
Code	Producing Sector	1	2	3	4	5	6	7	8
1.	Livestock and Agricultural Products	179.3	399.6	---	.9	27.1	2.4	1.8	16.9
2.	Food and Kindred Products	124.8	250.0	---	---	.8	.3	.2	---
3.	Mining	3.0	.9	48.5	5.4	.4	---	---	---
4.	Construction	16.6	4.6	21.5	.6	1.8	---	.3	7.9
5.	Textiles and Apparel	.6	2.6	1.4	5.8	393.5	.9	.1	1.5
6.	Misc. Primary Forest Products and Fisheries	---	7.8	---	---	3.2	.2	6.2	---
7.	Logging Camps and Logging Contractors	---	---	.5	---	---	---	6.7	25.7
8	Sawmills and Planing Mills	---	.2	.5	35.8	---	---	2.2	13.4
9.	Millwork and Plywood	---	---	---	45.2	---	---	.3	1.1
10.	Wood Containers	.6	1.8	---	---	---	---	---	.9
11.	Wood Buildings and Mobile Homes	---	---	---	9.0	---	---	---	---
12.	Miscellaneous Wood products	---	.1	---	12.3	.2	---	---	2.2
13.	Wood Furniture	---	---	---	3.6	---	---	---	---
14.	Pulp, Pap, & Bd. Mills; Misc. Pap. Prod.	.7	14.5	---	6.1	.6	---	.1	1.9
15.	Paperboard Containers and Boxes	.1	15.4	.5	---	3.3	---	---	.1
16.	Printing and Publishing	.3	5.6	---	---	.3	---	---	---
17.	Chem. & Allied: Petroleum & Other Mfg.	137.7	89.0	77.6	608.6	80.7	1.7	9.2	23.7
18.	Transportation	13.3	20.2	8.4	25.6	5.1	.4	8.3	14.0
19.	Communications and Utilities	5.7	6.6	7.1	3.4	3.7	---	.8	11.1
20.	Wholesale and Retail Trade	86.4	59.1	13.4	170.3	27.9	.7	3.7	9.6
21.	Finance, Ins., & Real Estate	26.6	4.3	26.0	6.3	3.1	.1	2.9	1.2
22.	Services	62.9	22.2	7.6	39.8	5.2	.3	.8	7.4
23.	State and Local Government	---	.3	---	.7	.1	---	.2	.6
	Total Endogenous	658.6	904.8	213.0	979.4	557.0	7.0	43.8	139.2
24.	Federal Government	.2	1.1	.5	.7	.2	.6	.6	2.3
25.	Households	751.8	171.1	212.9	611.8	263.3	14.4	16.3	58.7
26.	Imports	50.1	69.9	30.5	89.0	21.3	.5	22.3	79.2
	Total Gross Input	1460.7	1146.9	456.9	1680.9	841.8	22.5	83.0	279.4

[1] In millions of dollars, producers prices.

***A dash (---) in a cell indicates a value less than $.5 million.**

(continued)

Table 1. Continued

Sector Code	Producing Sector	Purchasing Sector Code*							
		9	10	11	12	13	14	15	16
1.	Livestock and Agricultural Products	12.3	---	---	---	.4	18.7	2.7	--
2.	Food and Kindred Products	---	---	---	---	---	3.8	---	--
3.	Mining	---	---	---	.4	---	4.6	---	--
4.	Construction	1.1	.2	.3	1.0	---	3.6	.1	.
5.	Textiles and Apparel	.2	.1	1.3	1.1	.3	7.0	.1	.
6.	Misc. Primary Forest Products and Fisheries	---	---	---	---	---	---	---	--
7.	Logging Camps and Logging Contractors	13.6	1.4	---	9.3	---	21.8	3.7	-
8.	Sawmills and Planing Mills	2.2	3.6	16.2	46.8	9.3	8.4	.1	--
9.	Millwork and Plywood	7.9	3.0	4.7	3.0	7.6	---	---	--
10.	Wood Containers	.1	2.3	.2	2.2	.1	---	---	--
11.	Wood Buildings and Mobile Homes	.3	---	2.1	---	.1	---	---	--
12.	Miscellaneous Wood products	.7	2.2	.3	4.9	1.1	1.3	---	--
13.	Wood Furniture	---	---	.1	---	.1	---	---	--
14.	Pulp, Pap, & Bd. Mills; Misc. Pap. Prod.	.5	.2	.3	4.6	---	39.8	9.0	13.
15.	Paperboard Containers and Boxes	.2	.2	.1	.8	.1	4.2	.3	1.
16.	Printing and Publishing	---	---	---	.1	---	2.6	.1	1.
17.	Chem. & Allied: Petroleum & Other Mfg.	12.5	3.4	13.7	26.9	.4	45.0	10.4	6.
18.	Transportation	7.4	1.7	1.8	11.4	.1	35.1	6.4	.
19.	Communications and Utilities	5.9	.4	.3	1.9	---	4.7	.2	.
20.	Wholesale and Retail Trade	7.9	3.5	5.0	11.7	.2	16.1	5.3	3.
21.	Finance, Ins., & Real Estate	.7	.3	.4	.7	---	2.0	.4	1.
22.	Services	3.5	.7	.7	2.6	.1	8.1	1.5	2.
23.	State and Local Government	.4	---	---	---	---	.8	.2	-
	Total Endogenous	77.4	23.2	47.5	129.4	19.9	227.6	40.5	32
24.	Federal Government	1.2	.1	.1	.2	.3	3.4	.6	1
25.	Households	31.0	18.1	16.1	61.2	11.4	78.2	10.6	32.1
26.	Imports	37.8	3.5	3.1	22.3	3.0	71.9	10.6	2.
	Total Gross Input	147.4	44.9	66.8	213.1	34.6	381.1	62.3	69

[1]In millions of dollars, producers prices.

*A dash (---) in a cell indicates a value less than $.5 million.

(continued

able 1. Continued

ector ode	Producing Sector	Purchasing Sector Code* 17	18	19	20	21	22	23
.	Livestock and Agricultural Products	11.9	.1	---	---	17.8	1.7	.1
.	Food and Kindred Products	14.0	1.6	---	12.7	1.4	1.7	---
.	Mining	220.6	.4	34.8	.1	2.8	.1	13.6
.	Construction	27.6	13.7	17.4	8.0	80.8	4.5	315.1
.	Textiles and Apparel	69.5	1.5	.2	4.4	1.1	1.3	1.5
.	Misc. Primary Forest Products and Fisheries	.1	---	---	---	---	---	---
.	Logging Camps and Logging Contractors	---	.1	---	---	---	---	---
.	Sawmills and Planing Mills	24.3	---	---	.4	.1	---	---
.	Millwork and Plywood	12.2	---	---	.4	.1	---	---
.	Wood Containers	5.3	---	---	1.6	---	---	---
.	Wood Buildings and Mobile Homes	1.2	---	---	.1	---	---	---
.	Miscellaneous Wood products	18.3	---	---	.4	---	---	---
.	Wood Furniture	8.6	---	---	.2	.1	---	---
.	Pulp, Pap, & Bd. Mills; Misc. Pap. Prod.	23.8	.6	.6	15.2	3.2	1.1	1.7
.	Paperboard Containers and Boxes	25.4	.2	---	4.2	---	.3	.1
.	Printing and Publishing	.5	.3	.3	3.6	3.8	21.1	1.1
.	Chem. & Allied: Petroleum & Other Mfg.	2012.5	40.8	9.0	78.9	28.5	38.5	63.9
.	Transportation	23.5	22.0	3.6	10.9	7.8	1.8	8.4
.	Communications and Utilities	31.0	3.5	30.2	25.0	8.9	9.9	68.2
.	Wholesale and Retail Trade	170.7	17.1	4.1	51.2	24.5	14.8	20.3
.	Finance, Ins., & Real Estate	25.8	5.0	2.3	37.5	44.3	6.7	13.7
.	Services	68.1	6.6	8.3	60.1	34.9	12.4	25.7
.	State and Local Government	.7	15.2	45.7	8.9	11.6	.8	1.1
	Total Endogenous	2795.6	128.7	156.5	323.8	271.7	116.7	534.5
.	Federal Government	6.2	1.1	7.4	27.1	14.0	7.2	2.4
.	Households	1193.7	160.1	140.9	1570.2	506.2	874.7	718.6
.	Imports	401.4	43.4	37.2	71.2	36.3	34.6	159.0
	Total Gross Input	4396.9	333.3	342.0	1992.3	828.2	1033.2	1414.5

[1]In million of dollars, producers prices.

***A dash (---) in a cell indicates a value less than $.5 million.**

(continued)

Table 1. Continued

Sector Code	Producing Sector	Total Endogenous Sales	Final Demand 24	25	Exports	Tot Gro Outp
1.	Livestock and Agricultural Products	693.7	2.9	22.2	741.0	146
2.	Food and Kindred Products	411.3	10.9	724.7	---	114
3.	Mining	335.6	1.7	1.6	118.0	45
4	Construction	527.2	84.0	562.6	507.1	168
5.	Textiles and Apparel	496.6	9.5	244.7	91.0	84
6.	Misc. Primary Forest Products and Fisheries	17.5	---	5.0	---	2
7.	Logging Camps and Logging Contractors	82.8	---	.2	---	8
8.	Sawmills and Planing Mills	163.5	---	---	115.9	27
9.	Millwork and Plywood	85.5	---	---	61.9	14
10.	Wood Containers	15.1	.4	---	29.4	4
11.	Wood Buildings and Mobile Homes	12.8	.1	---	53.9	6
12.	Miscellaneous Wood products	44.0	.4	2.9	165.8	21
13.	Wood Furniture	12.7	---	20.8	1.1	3
14.	Pulp, Pap, & Bd. Mills; Misc. Pap. Prod.	137.7	2.0	18.3	223.1	38
15.	Paperboard Containers and Boxes	57.2	.3	.4	4.4	6
16.	Printing and Publishing	41.2	19.0	9.1	---	6
17.	Chem. & Allied: Petroleum & Other Mfg.	3419.1	192.0	785.8	---	439
18.	Transportation	238.1	22.1	73.1	---	33
19.	Communications and Utilities	229.4	6.3	106.3	---	34
20.	Wholesale and Retail Trade	726.7	23.8	1019.2	222.6	199
21.	Finance, Ins., & Real Estate	211.8	4.7	611.7	---	82
22.	Services	381.9	79.0	572.3	---	103
23.	State and Local Government	87.3	5.7	584.0	737.5	141
	Total Endogenous	8428.7				
24.	Federal Government		4.8	856.6	661.6	160
25.	Households		986.5	---	330.0	884
26.	Imports		83.5	515.1	---	189
	Total Gross Input		1539.6	6736.6	4065.2	29,67

The basis of any input-output
alysis is a "transaction" or
ow" table that shows the dis-
bution of total dollar output to
ch producing industry in the
onomy and to the nonproducing
al demand sectors. The model
mpleted as part of this study has
rows and 26 columns (one row
each producing sector plus one
v for each nonproducing final
mand sector and a correspon-
ng column for each row).

Two other key components of
input-output analysis---the technical coefficients matrix and the interdependence coefficients matrix---are derived from the flow table. Input-output multipliers are derived from the technical coefficients and the interdependence coefficients matrices.

The contribution of any producing sector to the total output of the Mississippi economy can be determined by referring to Table 1 of this Appendix. For example, the pulp, paper and board industry (sector code 14) sold $6.1 million to the construction sector (purchasing sector code 4); $300 thousand to wood buildings and mobile homes (purchasing sector code 11) and had a total gross output of $381.1 million in 1974. Detailed information on purchases by each economic sector also can be determined by reading down the columns of the flow table. For example, sawmills paid $25.7 million to loggers for harvesting timber in 1974.

Multipliers

An input-output model is a
luable aid in showing economic
ructural interdependence but
so is useful in further economic
alysis. Any change in output in a
rticular producing sector will be
agnified to some extent because
economic sectoral linkages. The
agnification is a function of the
gree of structural in-
relationship and measures of
e overall economic effect of
tput changes are known as
ctor multipliers.

Multipliers are categorized as
pe I or Type II. Type I multipliers
flect only direct and indirect
fects of a change in economic
tivity (interindustry effects
ly). Type II multipliers account
r induced household effects as
ell. Type II multipliers always
ll be larger than Type I mul-
pliers because business-induced
usehold spending is included.

Output Multipliers (Table 2 of this Appendix) estimate the change in industrial production precipitated by a change in final demand. Type I multipliers are derived by summing the entries in each column of the interdependence coefficients matrix with households as an exogenous sector.[1]

Income multipliers estimate the statewide change in household income resulting from a $1 change in payments to the households in a given economic sector. Type I multipliers estimate the direct and indirect changes in household income for each $1 change in direct income payments to households. Type II multipliers include the effect of changes in household spending in response to changes in household income.

Employment multipliers estimate the statewide change in employment resulting from a change in employment in a given producing sector. Type I multipliers estimate the direct and indirect change in employment associated with a unit change in employment in a sector. Type II multipliers include the employment effect of the change in household spending resulting from a change in employment.

Type I multipliers generally underestimate and Type II multipliers generally overestimate the impact of sectoral economic activity on the total output, income and employment of an economy.[2] Consequently, averages of the Type I and Type II multipliers (Tables 2, 3 and 4 of this Appendix) were used to project the total output, income and employment resulting from changes in productivity of the Mississippi forest industry.

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[1] *The interdependence coefficients matrices and the technical coefficients matrices used to derive all*
ultipliers reported in Tables 2, 3 and 4 of this Appendix are omitted to conserve space. Readers interested in
amining them may see Terfehr, Thomas Raymond, **The Economic Contribution of Forestry to**
ssissippi: An Application of Input-Output Analysis, *unpublished Master's Thesis, Mississippi State*
iversity, May 1976.

[2] *A fuller explanation of the input-output model and the multiplier effects is available from the senior author,*
partment of Forestry, Mississippi State University.

Table 2. 1974 Mississippi output multipliers, by Sector.[1]

Sector		Type I	Type II	Average of Type I and Type
1.	Livestock and Agricultural Products	1.91	5.80	3.86
2.	Food and Kindred Products	2.68	6.26	4.47
3.	Mining	1.96	5.61	3.78
4.	Construction	2.24	5.80	4.02
5.	Textiles and Apparel	2.63	6.43	4.53
6.	Miscellaneous Primary Forest Products and Fisheries	1.64	5.62	3.63
7.	Logging Camps and Logging Contractors	2.00	4.65	3.32
8.	Sawmills and Planing Mills	1.98	4.54	3.26
9.	Millwork and Plywood	2.01	4.67	3.34
10.	Wood Containers	2.00	5.38	3.69
11.	Wood Buildings and Mobile Homes	2.47	5.70	4.08
12.	Miscellaneous Wood Products	2.22	5.30	3.76
13.	Wood Furniture	2.16	5.13	3.64
14.	Pulp, Paper and Board Mills; Miscellaneous Paper Products	2.22	5.09	3.66
15.	Paperboard Containers and Boxes	2.30	5.21	3.76
	TOTAL FOREST INDUSTRY	2.13	4.99	3.56
16.	Printing and Publishing	1.97	5.54	3.76
17.	Chemical and Allied; Petroleum; Other Manufacturing	2.45	5.79	4.12
18.	Transportation	1.76	5.18	3.47
19.	Communications and Utilities	1.86	5.26	3.56
20.	Wholesale and Retail Trade	1.30	5.27	3.28
21.	Finance, Insurance, and Real Estate	1.61	5.45	3.53
22.	Services	1.22	6.30	3.76
23.	State and Local Government	1.79	5.31	3.55
Mississippi economy (average) multiplier		2.02	5.45	3.74

[1]See Footnote 1 of this Appendix.

able 3. 1974 Mississippi Income Multipliers, by Sector.[1]

ector		Type I	Type II	Average of Type I and Type II
1.	Livestock and Agricultural Products	1.76	2.99	2.38
2.	Food and Kindred Products	5.56	9.48	7.52
3.	Mining	1.83	3.09	2.46
4.	Construction	2.28	3.86	3.07
5.	Textiles and Apparel	2.85	4.80	3.82
6.	Miscellaneous Primary Forest Products and Fisheries	1.40	2.36	1.88
7.	Logging Camps and Logging Contractors	3.15	5.32	4.24
8.	Sawmills and Planing Mills	2.83	4.82	3.82
9.	Millwork and Plywood	2.01	4.67	3.34
0.	Wood Containers	1.95	3.31	2.63
1.	Wood Buildings and Mobile Homes	3.13	5.30	4.22
2.	Miscellaneous Wood Products	2.50	4.24	3.37
3.	Wood Furniture	2.10	3.56	2.83
4.	Pulp, Paper and Board Mills; Miscellaneous Paper Products	3.25	5.53	4.39
5.	Paperboard Containers and Boxes	3.97	6.77	5.37
	TOTAL FOREST INDUSTRY	2.92	4.97	3.94
6.	Printing and Pulishing	1.78	3.04	2.41
7.	Chemical and Allied; Petroleum; Other Manufacturing	2.87	4.86	3.86
8.	Transportation	1.66	2.81	2.24
9.	Communications and Utilities	1.92	3.26	2.59
0.	Wholesale and Retail Trade	1.17	1.98	1.58
1.	Finance, Insurance, and Real Estate	1.46	2.48	1.97
2.	Services	1.11	2.37	1.74
3.	State and Local Government	1.62	2.73	2.18
ississippi economy (average) multiplier		2.39	4.09	3.24

[1] See Footnote 1 of this Appendix.

Table 4. 1974 Mississippi Employment Multipliers, by Sector.[1]

Sector		Type I	Type II	Average of Type I and Type
1.	Livestock and Agricultural Products	1.55	3.01	2.28
2.	Food and Kindred Products	5.30	10.71	8.00
3.	Mining	3.14	9.94	6.54
4.	Construction	2.63	6.20	4.42
5.	Textiles and Apparel	2.38	4.12	3.25
6.	Miscellaneous Primary Forest Products and Fisheries	2.64	8.55	5.60
7.	Logging Camps and Logging Contractors	1.42	2.10	1.76
8.	Sawmills and Planing Mills	2.50	4.65	3.58
9.	Millwork and Plywood	3.24	6.43	4.84
10.	Wood Containers	1.97	4.04	3.00
11.	Wood Buildings and Mobile Homes	3.53	7.49	5.51
12.	Miscellaneous Wood Products	2.48	4.92	3.70
13.	Wood Furniture	1.71	2.95	2.33
14.	Pulp, Paper and Board Mills; Miscellaneous Paper Products	4.23	9.06	6.64
15.	Paperboard Containers and Boxes	3.65	7.48	5.56
	TOTAL FOREST INDUSTRY	3.07	6.27	4.67
16.	Printing and Publishing	1.64	3.40	2.52
17.	Chemical and Allied: Petroleum; Other Manufacturing	2.80	6.27	4.54
18.	Transportation	1.71	3.78	2.74
19.	Communications and Utilities	1.77	3.55	2.66
20.	Wholesale and Retail Trade	1.19	2.78	1.98
21.	Finance, Insurance, and Real Estate	1.80	5.07	3.44
22.	Services	1.13	3.04	2.08
23.	State and Local Government	1.28	2.22	1.75
Economy (average) multiplier		2.42	5.29	3.86

[1] See Footnote 1 of this Appendix.

GLOSSARY OF TERMS[1]

Annual Growth---Annual increase in timber volume in the absence of cutting and mortality.

Board Foot---A piece of lumber measuring one foot square and one inch thick. MBF is one thousand board feet.

Commercial Forest Land---Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization. Virtually all of Mississippi's forest land is classified as commercial forest land.

Cord---A stack of wood (wood, bark and air) measuring 4 feet by 4 feet by 8 feet long; 128 cubic feet.

Employment Multipliers---These multipliers show the total change in statewide employment resulting from the addition of one employee in a particular industry. Type I employment multipliers estimate the effect due to industry changes within the economy. Type II employment multipliers include the type I effect plus that due to induced household spending.

Endogenous Sectors---Industries within Mississippi that produce goods and services for sale to other industries or for final consumption (exogenous sectors).

Exogenous Sectors---Nonproducing sectors that purchase goods and services from endogenous industries. Once products enter exogenous sectors, they are "used" by these final demand sectors.

Fully Stocked Natural Stand---Stocking is a measure of the extent to which the growth potential of the site is utilized by trees or preempted by other vegetative cover. Full stocking assumes the entire tree growing potential of the site is captured by the existing stand of trees.

Growing Stock Trees---Sawtimber trees, poletimber trees, and saplings (down to a 1.0 inch diameter at 4.5 feet from the ground); that is, in essence, all live trees except rough and rotten trees.

Growth-Harvest Ratio---Annual growth of timber volume divided by annual volume harvested. Ratios greater than 1.0, equal to 1.0 and less than 1.0 indicate growth in excess of harvest, growth equals harvest and growth less than harvest, respectively.

Hardwoods---Usually broadleaf trees that lose their leaves in the fall.

Induced Effect---The impact of changes brought about by household spending. Increased household income will result in increased industrial output as households spend the income.

Income Multipliers---These multipliers indicate the statewide effect on total household income of a one dollar increase in payments to households by a particular industry. Type I income multipliers measure the change due to interactions among industries in the State. Type II income multipliers include the changes due to industry interactions and the *induced* effect due to household spending.

Input-Output Analysis---A systematic method of analyzing the interrelationships between an industry's output of goods and services and the volume of goods and services needed to achieve a given level of production (Curtis, 1972).

Inter-Industry---Transactions between industrial sectors.

Interdependence Coefficient Matrix---A table showing the total output (both *direct* and *indirect*) required from each industrial sector when a particular industry expands output by one dollar. For a given industry to produce and sell output it must purchase materials from other industries. These purchases are termed *direct* effects. All industries, in turn, purchase goods and services from various sectors of the economy to carry on their production. These are *indirect* effects.

Interindustry Transaction Matrix---A table showing the distribution of sales (output) by each industrial sector to all other industries and to final consumers (final demand). This table also shows the distribution of total purchases by each industry. The table is a listing of the flow of dollars within the economy.

Intra-Industry---Transactions among firms within one industrial sector.

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[1] *Glossary based in part on definitions of terms found in Van Sickle and Van Hooser, 1969.*

Output Multipliers---These multipliers indicate the effect on the total Mississippi economy of a one dollar increase in output from a particular industry. Type I output multipliers measure the effect due to industry changes within the economy. Type II multipliers measure the impact of industry changes plus the *induced* effect due to household spending.

Primary Industries---Basic industries in which an area specializes---industries that generally produce more than that area needs; i.e., exports its product. Examples are agriculture, mining, manufacturing and railroads.

Roundwood---Logs, bolts or other round sections cut from trees for industrial or consumer uses. Wood is unprocessed in this form.

Sawtimber trees---Live trees of commercial species---softwoods 9.0 inches and larger in diameter 4.5 feet from the ground, hardwoods 11.0 inches and larger and containing at least one 12-foot sawlog.

Secondary Industries---Industries providing goods and services for the primary industries.
amples are transportation, t
services and local governm

Small, Nonindustrial, Pr
Forest Ownership---N
corporate, non-public f
ownerships of less than
acres.

Softwoods---Coniferous tr
usually evergreen, with need
scale like leaves.

Visitor Day---A visit tha
equivalent to a twelve-hour s
Two people staying six h
would equal one visitor day

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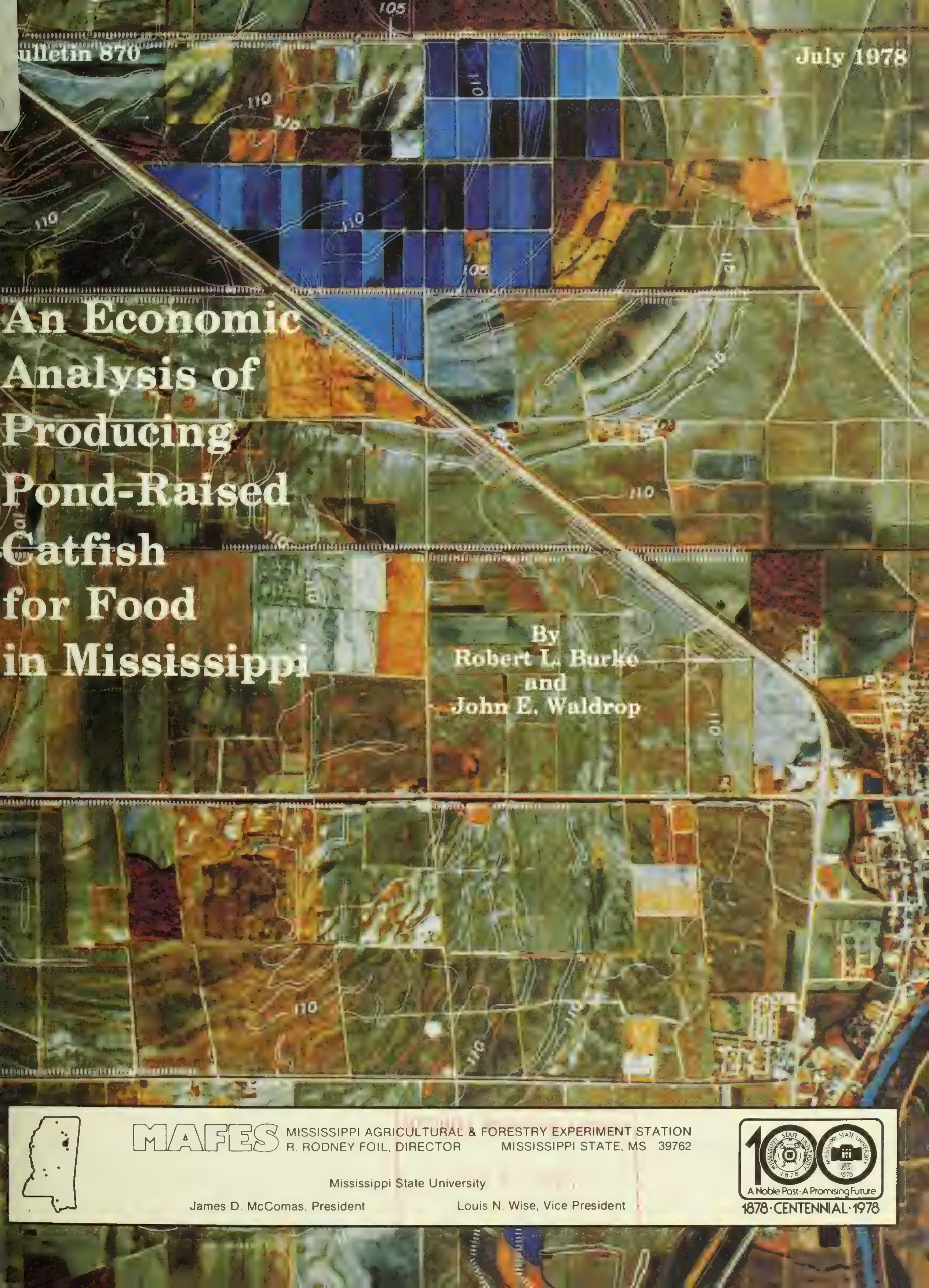
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An Economic Analysis of Producing Pond-Raised Catfish for Food in Mississippi

By
Robert L. Burke
and
John E. Waldrop

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An Economic Analysis of Producing Pond-Raised Catfish for Food in Mississippi

by

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Mississippi Agricultural and Forestry Experiment Station
Mississippi State, Mississippi

July 1978

PREFACE

This report is Mississippi's contribution to Objective II, Regional Project S-83 Revised.

We express our appreciation to many individuals and agencies for their contribution. Personnel of the Mississippi Cooperative Extension Service, the Soil Conservation Service, Cooperative Feed Mill, Isola, Mississippi and others that supply equipment, materials and services to the catfish industry contributed essential data.

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SUMMARY AND CONCLUSIONS

Recommendations obtained from professionals in the field of catfish production, and data supplied by producers, suppliers, and other experts were used to estimate total and per pound costs of producing catfish on farms of three sizes. The three farm sizes were 163 acres, 323 acres, and 643 acres---Farm Situations I, II, and III, respectively. Pond size was 20 land acres for each of the three farm situations, with 3 acres used for facilities, roads, and buildings. Water was supplied by one 16-inch well powered by a 60 h.p. diesel engine for each 4 ponds. The research method used was economic engineering or synthetic firm analysis.

Estimates of production costs per pound of harvested fish were: $.436 for Farm Situation I, $.392 for Farm Situation II; and $.373 for Farm Situation III.

The cost information was used to develop cash flow schedules. Monthly cost and return schedules were developed for each of the three farm situations for one production period. In addition, expected cash expenditures and receipts were developed for selected lengths of loan and interest rates, selected equity situations, and selected product prices. At 1977 prices for catfish, expected revenues exceeded estimated production costs for all equity situations and for all length of loan situations.

Cost sensitivity analysis was performed to estimate the cost effect of changes in prices of feed and fingerlings (the major cost components) and for selected stocking rates. A 10% change in feed price results in less than a 3 cent change in total cost per pound. A 10% change in fingerling price results in a very small change in total cost per pound. Each 500-fish-per-surface-acre increase in stocking rate increases total costs but reduces per pound cost.

It appears that, under current conditions, the catfish enterprise is feasible and relatively profitable. However, substantial increases in production may decrease the product price but lack of knowledge of the demand for catfish precludes determination of the price effect of increased production. Obviously, demand has increased over the past 10 to 12 years, but the rate of increase is not known. Results of the cost sensitivity analysis included in this study indicate that catfish production would remain feasible even at product prices much lower than those now faced by producers.

An Economic Analysis of Producing Pond-Raised Catfish for Food in Mississippi

The area used to produce food fish in the Delta of Mississippi was estimated to be 15,000 acres in 1976, up about 13,000 from 1967. This acreage accounts for about one half of the total area devoted to the production of catfish for food in the United States. Growth of the industry has not, however, been limited to acreage increases because advancements in technology and production practices have allowed the productivity of individual units to increase significantly.

THE PROBLEM

Reports of the relatively favorable incomes derived from producing catfish for food have led numbers of individuals and groups to seek entry into the industry. However, the industry is relatively new and much of the information necessary for assessing its status and potential is not readily available. Also, much of the available technical information does not reflect the latest technology and earlier economic studies do not reflect current prices for many inputs; i.e., fuel, feed, machinery, and labor.

OBJECTIVES

This study was designed for assessing the economic feasibility of current and/or new capacity for the production of catfish in Mississippi.

Specific objectives of the study were to:

1. Estimate costs of commercial catfish production with current production practices and input prices.
2. Construct cash flow schedules of capital requirements and use them to assess the adequacy of revenues to meet "payback" requirements for assets financed by credit.
3. Assess the sensitivity of costs to changes in prices of selected inputs.

PROCEDURE

Economic-engineering synthesis was used to develop hypothetical firms representative of the three sizes of catfish operations most prevalent in Mississippi [23].[1] Each hypothetical firm reflects the combination of production resources and the production practices recommended in 1977. The input-output coefficients generated by analysis of each synthetic firm were used to estimate costs of production, with each resource valued at its opportunity cost [12, p. 144].

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[1] *Numbers in brackets refer to literature cited at the end of this report.*

The estimates of production costs were used to construct schedules of monthly cash expenses of each hypothetical firm for one year. Schedules of cash expenses and receipts were constructed to permit evaluation of the economic feasibility of expanding commercial catfish production under different equity situations and with repayment of loans over different time periods. Feed and fingerling costs account for a relatively large percentage of total costs; therefore, changes in total costs associated with specified changes in prices of these items were determined. Also, the impact of different stocking rates on cost of production and net returns was estimated for specified catfish prices.

Detailed discussions of each segment of the catfish operation are presented in the Appendix.

SOURCES OF DATA

Coefficients for pond construction were developed with the aid of Mr. Tom E. Blaylock, District Engineer, Soil Conservation Service, Greenwood, Mississippi. Information on costs of wells and pipe was obtained from Mr. Max Harper, Butane Gas Company, Greenwood, Mississippi. The disease, parasite and weed control program was developed with the aid of Dr. Thomas L. Wellborn, Leader, Department of Wildlife and Fisheries, Mississippi Cooperative Extension Service, Mississippi State University. Feed prices were calculated from data supplied by Producers Feed Mill, Isola, Mississippi. Harvesting coefficients were developed with the aid of Mr. Donald C. Greenland, Fishery Biologist, and Mr. J. Mayo Martin, Extension Biologist, U. S. Fish and Wildlife Service Fish Farming Experiment Station, Stuttgart, Arkansas.

Prices of seines, live cars, and other harvesting equipment were obtained from Delta Net and Twine, Greenville, Mississippi and McCrary's Farm Supply, Lonoke, Arkansas. Prices of feed bins were supplied by Butler Manufacturing Company, Taylorsville, Illinois. The price of a feeder was supplied by Neilson Metal Industries, Salem, Oregon.

Agents of the Mississippi Cooperative Extension Service in various counties furnished valuable service in locating producers and supplying other general information about the catfish industry in the Delta. Many other individuals and groups who contributed to the development of this study are not named because of limited space.

The practices outlined through consultation with the above-named public and private experts were reaffirmed by visits with cooperating catfish farmers.

SYNTHESIZED FIRMS

Synthetic firms were developed for operations with 163 land acres (Farm Situation I), 323 land acres (Farm Situation II), and 643 land acres (Farm Situation III). Assumptions underlying the synthesis of firms of each size were that the catfish enterprise was separate from all other enterprises and that the firms were to incorporate the most advanced production practices and procedures recommended at this time.

The Basic Production System

The production system for hypothetical firms of each size specified stocking on March 15 with 4000 1-ounce fingerlings per surface acre of water and harvesting 210 days later (October 15). A loss of 200 fish per acre was projected to account for mortality and for fish that escape harvest. Estimated returns are based on an average harvest weight of 20 ounces---a net gain of 19 ounces. Costs were based on the consumption of 1.6 pounds of feed per pound of gain.

The assumption was made that total production would be reduced by 2.5% per year because of pond repairs and maintenance.[2] The underlying assumptions and projected growth rates result in total production of 4631 pounds per acre of water (Table 1).

Production was based on stocking with 4000 1-ounce fingerlings per acre, 5% loss, 19 ounce gain per fingerling and 1.6:1 feed conversion. Details of the basic system are discussed at length in the Appendix.

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[2] *Assumptions about repair and maintenance of ponds are discussed in detail in the section of this report entitled "Annual Operating Costs".*

Land

Synthesized firms of each size were assumed to have level or nearly level land available in 163-acre plots with an adequate supply of water within 100-125 feet of the surface [9]. Available soil was a clay type with good water-holding capacity and near to natural drainage to enhance the movement of water from the farm when ponds needed to be drained.

Pond Construction

Levee designs for all farm situations include a 14-foot crown with gravel sufficient to permit all-weather access, a 3:1 side slope, a fifty-foot base, and a minimum water depth of four feet with a two-foot freeboard.[3] Each pond is bordered on at least one side by a drainage ditch that measures three feet at the bottom and twelve feet at the top. An eight-foot berm between the ditch and the base of the levee is included in the levee design.

Pond Size

Farm Situation I contains 8 ponds of 20 land acres each; Farm Situation II, 16 ponds of 20 land acres each; and Farm Situation III, 32 ponds of 20 land acres each.[4] The 20 acre pond size was selected because it was reported earlier to permit minimum per pound cost of producing catfish [6]. Also, many producers appear to be favoring ponds of this size and current stocking rates coupled with processing capacity indicated this to be the appropriate pond size for analysis. Surface acres of water per pond are less than 20 because some land is used for levees and drainage structures. (Table 2).

Table 1. Estimated total production and production per pond and per acre, three farm situations, Delta of Mississippi, 1977.

Item	Farm Situation I	Farm Situation II	Farm Situation III
	Pounds		
Total Production	655,785	1,323,611	2,653,243
Production per Pond	81,973	82,726	82,914
Production per Acre of Water	4,631	4,631	4,631

Table 2. Total acres of land, surface acres of water, number of ponds, and surface acres per pond, three farm situations, Delta of Mississippi, 1977.

Item	Farm Situation I	Farm Situation II	Farm Situation III
Total land acres	163	323	643
Surface acres of water	141.6	285.8	572.9
Number of ponds	8	16	32
Surface acres per pond	17.7	17.8	17.9

Table 3. Number of wells and feet of pipe required, three farm situations, Delta of Mississippi, 1977.

Farm Situation	Number of Wells	Feet of Discharge Pipe
I	2	300
II	4	600
III	8	1200

Water Supply

Water is the medium of growth and a critical managment tool in catfish production. Therefore, factors other than the minimum requirements in determining water quantity needed to sustain catfish must be considered. Major considerations in addition to supplying fresh water to sustain growth are replacement of evaporation and water requirements during periods of stress. Provisions also must be made for adequate aeration and chemical treatment of water.

Wells are selected as the water source and numbers of wells for each farm situation (Table 3) were based on minimum flow requirements and on observations of numbers and placement of wells on the catfish operations visited. Wells are rated at 3000 g.p.m.

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[3] *Depth of water will approach five feet on the average.*

[4] *This does not include the three acres available for buildings, equipment storage and other support facilities.*

Feeding

Feed requirement was estimated to be 7448 pounds of pellet per surface acre per year. This estimate was based on a 1.6:1 feed conversion ratio and includes 60% of the quantity of feed that would have been consumed by the fish that were assumed to die or escape harvest. Facilities required for handling the tonnage of feed for each situation (Table 4) are feeders (p.t.o.-driven 2000-pound capacity) and feed storage bins (23-ton capacity gravity feed bin 25′ from ground to top).

Table 4. Estimated annual feed requirements, three farm situations, Delta of Mississippi, 1977.

Farm Situation	Feed Requirements
	Tons
I	527.32
II	1,064.32
III	2,133.11

Harvesting

Producers have changed from the "mechanized haul seine technique" to using two tractors to position and haul the seine. All producers observed used some variation of this technique.

Disease, Parasite and Weed Control

Equipment for applying materials consists of a boat, fitted with a chemical mixing and application chamber, an outboard motor, a boat trailer, and an oxygen meter and probe.

Miscellaneous

Some inputs associated with production are used by more than one segment of the operation. These were grouped under "Miscellaneous".

ESTIMATED INVESTMENT REQUIREMENTS AND ANNUAL PRODUCTION COSTS

Catfish production is capital intensive and the high capital requirement usually presents two problems to producers: (1) financing the original investment, and (2) financing annual production expenses. Estimates of capital requirements are needed to assess the economic feasibility of production. Prices obtained from suppliers were used to derive estimates of investment requirements in 1977.

Investment Requirements

Investment requirements for each farm situation can be segmented into seven major groups. These include land; pond construction; water supply; feeding; disease, parasite and weed control; harvesting; and miscellaneous equipment.

Total investment was $291,334 for Farm Situation I, $490,001 for Farm Situation II, and $902,796 for Farm Situation III (Table 5).

Land---Land was valued at $552 per acre---the average value of land in the Delta of Mississippi in 1974 adjusted for the reported increase in land values in the State from 1974 to 1977 [18].

Pond Construction---Initial investment in levee construction did not increase in proportion to the increase in land acreage because of differences in the proportion of innner and outer levees. Construction costs were based on an estimated charge of 40 cents per cubic yard of earth moved (Appendix Table 1).

Water Supply---Other sizes of wells are available but the 3000 g.p.m. unit met both flow requirements and least cost criterion for facilities of each size, with one well serving four ponds. Slight size economies were realized because surface acres of water per pond increased with increases in farm size.

Feeding---Economies of size were observed in the investment required for the feeding operation. In other words, the amount of equipment did not increase in proportion to the increase in fish produced.

Disease, Parasite, and Weed Control---Substantial economies of size occurred, because the same equipment was required for the three farm sizes.

Harvesting---Significant economies of size were realized in harvesting equipment because total investment was $12,068 for farms of each size.

Miscellaneous Equipment---Investment in miscellaneous equipment was substantial. Items included in miscellaneous were required in two or more investment categories.

Table 5. Estimated total investment, three farm situations, Delta of Mississippi, 1977.

Item	Farm Situation I	Farm Situation II	Farm Situation III
	-----------	dollars	-----------
Land	85,086	168,606	335,646
Pond construction	68,316	129,778	259,043
Earth moving	50,036	94,102	188,470
Drainage structures	10,800	21,600	43,200
Gravel	6,547	12,458	24,144
Vegetative cover	933	1,618	3,229
Water supply (wells and drainage pipes)	32,150	64,300	128,600
Feeding (feeder and bulk storage)	6,020	7,920	13,940
Disease, parasite, and weed control	2,564	2,564	2,564
Harvesting	12,068	12,068	12,068
Miscellaneous equipment	85,130	104,765	150,935
Tractors (90-100 h.p.)	42,500	59,500	93,500
1½ ton truck	7,000	7,000	7,000
½ ton truck	4,800	4,800	9,600
18′ x 42′ service building	16,000	16,000	16,000
16″ p.t.o. driven high lift pump	7,905	10,540	15,810
6′ side-mount mower	2,100	2,100	4,200
Farm shop equipment	4,000	4,000	4,000
Fiberglas transport tank	400	400	400
Waders	425	425	425
TOTAL	291,334	490,001	902,796
Investment per surface acre of water	2,057	1,714	1,576
Investment per acre of land	1,787	1,517	1,404

Annual Ownership Cost

Annual ownership cost is made up of depreciation charges, interest charges, taxes, and insurance. These costs are reported in Table 6.

Depreciation---The straight line method was used to calculate depreciation of all equipment and facilities except ponds. Estimates of expected life were obtained from dealers, manufacturers' specifications, and other published material [2].

Current knowledge of life expectance of ponds is not adequate for determining the "best" method of depreciation. We consulted many producers and decided that an expenditure of one-half of the original investment on pond construction would be required after ten years in production. This cost was converted to an annual rate for each farm situation. This is not to say that one-half the levees must be restored after ten years; however, those levees deteriorating to the point that production is adversely affected must be restored. Estimates of pond depreciation ranged from $3,417 for Farm Situation I to $12,952 for Farm Situation III (Table 6).

Depreciation of water supply facilities was calculated by summing the depreciation of separate components of the system and is $2,923, $5,846 and $11,693 for Farm Situations I, II, and III respectively.

Depreciation of the feeding system includes a charge for feeders and feed bins and is estimated to be $602 for Farm Situation I, $792 for Farm Situation II, and $1,394 for Farm Situation III.

Investment in harvesting equipment is the same for each Farm Situation and depreciation is $1,827.

Depreciation of miscellaneous equipment is a major portion of annual ownership cost and is $8,157 for Farm Situation I, $9,836 for Farm Situation II, and $13,371 for Farm Situation III.

Interest on Investment---Interest costs are the sum of interest charged on investment items and were computed at a rate of 9% of the full value of land and chemicals on hand, 9% on pond construction and 10% of one-half the investment in other depreciable items.

Interest on land was $7,658 for Farm Situation I, $15,175 for Farm Situation II, and $30,208 for Farm Situation III.

Interest charges for ponds were $3,074 for Farm Situation I, $5,840 for Farm Situation II, and $11,657 for Farm Situation III.

Interest charges for miscellaneous equipment were calculated in a similar manner for each and ranged from $3,830 for Farm Situation I to $6,792 for Farm Situation III.

Taxes and Insurance---Identification of a typical tax rate for land in the Delta of Mississippi is difficult. However, information was available on 10 representative farms in Sunflower County, Mississippi [3]. Based on this information a charge of $2.30 per acre was made for each situation.

Table 6. Estimated annual ownership costs, three farm situations, Delta of Mississippi, 1977.

Item	Farm Situation I	Farm Situation II	Farm Situation III
	---------dollars---------		
Annual Ownership Costs:			
Depreciation			
Ponds	3,417	6,489	12,952
Water supply (wells and discharge pipe)	2,923	5,846	11,693
Feeding (feeder and storage)	602	792	1,394
Harvesting equipment	1,827	1,827	1,827
Disease, parasite and weed control equipment	270	270	270
Miscellaneous equipment	8,157	9,836	13,371
Interest on Investment			
Land	7,658	15,175	30,208
Pond construction (drainage structures, gravel and vegetative cover)	3,074	5,840	11,657
Water supply (wells and discharge pipe)	1,462	2,924	5,847
Feed equipment (feeder and storage)	301	396	697
Disease, parasite and weed control equipment	105	105	105
Chemicals on hand	42	42	42
Harvesting equipment	432	432	432
Miscellaneous equipment	3,830	4,714	6,792
Taxes and Insurance	2,671	3,437	5,106
TOTAL	36,771	58,125	102,393

A reputable insurance company estimated insurance rates for labor and equipment. We applied these to each farm situation to determine insurance costs.

Annual Operating Costs

Annual operating costs are incurred only if production occurs. These costs include repairs and maintenance, fuel, chemicals, fingerlings, feed, labor, and interest on operating capital. These costs are reported in Table 7.

Repairs and Maintenance---Repair and maintenance costs were based on dealers' estimates, manufacturers' specifications and other published material as to expected repairs over the life of the item, and were computed as a percentage of the estimated purchase price [2,4].

Fuel---Estimates of fuel consumption were developed with the aid of Mr. Francis E. Rhodes.[5] The two fuel-use categories were pumping and power. Cost of pumping refers to fuel requirements for the diesel engines supplying power to pump water. Power cost refers to cost of fuel for tractors, trucks, and the outboard motor.

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[5] *Mr. Rhodes is a Teaching Research Assistant with the Department of Agricultural and Biological Engineering, at Mississippi State University.*

Chemicals---Calculations were done per surface acre of water. The costs reported are the sum of chemicals used for parasite, disease, and weed control.

Fingerlings---Fingerling costs were based on a stocking rate of 4000, 6-inch fingerlings per acre, priced at $.06 each.

Feed---The price used in estimating total feed cost for each situation was $263.78 per ton---the weighted average weekly price of the major supplier in the area during 1977. An additional charge of $75 per ton was included for medicated feed used in the disease program.

Labor---Labor costs for the three farm situations include costs of full-time and part-time (harvest labor) labor. Labor costs for Farm Situation I included the services of a manager, a foreman, two full-time people, and 606 hours of harvest labor. Farm Situation II employed a manager, a foreman, three full-time people, and 1207 hours of harvest labor. A manager, an assistant manager, a foreman, four full-time people and 2666 hours of harvest labor were included in labor costs for Farm Situation III.

Table 7. Estimated annual operating costs, three farm situations, Delta of Mississippi, 1977.

Item	**Farm Situation** I	II	III
	-----------	**dollars**	-----------
Annual Operating Costs:			
Repairs and maintenance	7,427	10,983	16,193
Vegetative cover	712	1,235	2,464
Water supply (wells and discharge pipe)	964	1,929	3,858
Feeding equipment (feeder and storage)	404	499	903
Disease, parasite and weed control	123	123	123
Harvesting equipment	703	703	703
Miscellaneous equipment	4,521	6,494	8,142
Fuel	13,635	25,475	50,657
Pumping	9,196	18,116	36,305
Power, transportation, feeding, harvest, etc.	4,439	7,359	14,352
Chemicals	2,093	4,135	7,475
Fingerlings	33,984	68,592	137,495
Feed (35% protein floating)[1]	142,419	287,479	575,303
Labor			
Management	20,000	20,000	32,000
Hired labor (full time)	20,000	26,000	32,000
Hired labor (for harvest)	1,818	3,622	7,333
Interest on operating capital	8,045	14,869	28,616
TOTAL	249,421	461,155	887,072

[1] An additional charge of $75/ton was made for medicated feed used for disease treatment.

Cost Summary

Total cost was $286,192, $519,280, and $989,465 for Farm Situation I, II, and III, respectively, Table 8. These costs convert to per pound costs of $.436 for Farm Situation I. $.392 for Farm Situation II, and $.373 for Farm Situation III.

Because of a lack of knowledge of the risk involved in producing catfish, and the risk preference of catfish producers, no attempt was made to estimate the cost of entrepreneurship for the catfish industry. A per pound price of catfish substantially higher than these estimated costs might be required to attract and hold resources in catfish production because no charge was made for that portion of management provided by the entrepreneur.

Each cost component was converted to a percentage of total costs to facilitate comprehension of the relative contribution of the many cost components that comprise total annual costs. These data are presented in Table 9.

Feed and fingerling costs make up a larger percentage of total costs than do all other cost components combined.

Annual ownership costs, as a percentage of total costs, decreased from 12.83% to 10.33% as farm size increased from 163 acres to 643 acres. Annual operating costs, as a percentage of total costs, increased from 87.17% to 89.67% as farm size increased from 163 acres to 643 acres.

Annual operating costs make up 87.17%, 88.85%, and 89.67% of total cost for Farm Situations I, II, and III, respectively. Operating costs are such a large portion of total costs that significant changes in the annual supply of catfish would be expected if prices should fall appreciably below costs estimated in this study. Knowledgeable producers will produce in the short run, if returns are greater than or equal to operating costs (variable costs) [10].

CASH FLOW ANALYSIS

Cash flow analysis is a financial management tool for assisting in planning and managing business activities. The technique allows projections of expected cash expenditures and cash receipts over specified time periods [11]. These projections enable producers to foresee periods when operating costs are highest and to arrange for a line of credit in advance. Exercising the credit option reduces interest payments because the length of term of loans is shorter. Producers also are in a position to arrange for at least a portion of their inputs before the production period starts and this gives the manager time to seek the best sources of inputs.

Monthly Cash Flows

Estimates of monthly cash expenditures (Tables 10-12) are based on the coefficients presented in earlier sections of this report. Monthly expenditures are highest in March when fingerlings are stocked and in September when the largest amount of feed is consumed.

Annual Cash Flows

Schedules of annual cash expenditures and receipts were constructed for different equity situations and for loans of different duration. The assumed equity situations and durations of repayment periods were:

Equity Situation I---No equity and fixed repayment periods; i.e., the entire investment in land, buildings, machinery and equipment is financed for five years at an annual interest rate of 10% and operating costs are financed for four months of each year at an annual interest rate of 10%.

Equity Situation II---A 25% equity and fixed repayment period; i.e., 75% of the investment in land, buildings, machinery, and equipment is financed for five years and operating costs are financed for four months of each year at an annual interest rate of 10%.

Equity Situation III---No equity and variable repayment periods; i.e., all necessary funds are borrowed but repayment schedules vary by cost component. The investment in land and the storage building is financed for 20 years at an annual interest rate of 9%. Investment in depreciable machinery and equipment is financed at an annual interest rate of 10% but repayment schedules vary with expected life of the equipment---all items with a five-year depreciation schedule are financed for five years. All other depreciable items are financed for seven years. Operating costs are financed for four months of each year at an annual interest rate of 10%.

Table 8. Catfish Production: Summary of total annual cost and cost per pound, three farm situations, Delta of Mississippi, 1977.

	Farm Situation		
Item	I	II	III
	-----------	dollars	-----------
Total Annual Cost	286,192	519,280	989,465
Annual Ownership Cost	36,771	58,125	102,393
Annual Operating Cost	249,421	461,155	887,072
Total Cost per Pound[1]	.436	.392	.373
Ownership Cost per Pound	.056	.044	.039
Operating Cost per Pound	.380	.348	.334

[1] Total cost per pound was computed by dividing total annual cost by total pounds of production for each Farm Situation. Total production was 655,785, 1,323,611, and 2,653,243 pounds for Farm Situation I, II, and III, respectively.

Table 9. Estimated annual cost components expressed as a percent of total cost, three farm situations, Delta of Mississippi, 1977.

	Farm Situation		
Item	**I**	**II**	**III**
	-------% of total cost-----		
Annual Ownership Costs:	12.83	11.15	10.33
Depreciation:	6.00	4.82	4.18
Pond construction	1.19	1.25	1.30
Water supply	1.02	1.13	1.18
Feeding equipment	.21	.15	.14
Harvesting equipment	.64	.35	.18
Disease, parasite and weed control equipment	.09	.05	.03
Miscellaneous equipment	2.85	1.89	1.35
Interest on investment:	5.90	5.67	5.63
Land	2.68	2.90	3.05
Pond construction	1.07	1.12	1.18
Water supply	.51	.56	.59
Feeding equipment	.11	.08	.07
Harvesting equipment	.04	.02	.01
Disease, parasite, and weed control equipment	.15	.08	.04
Miscellaneous	1.34	.91	.69
Taxes and Insurance	.93	.66	.52
Annual Operating Costs:	87.17	88.85	89.67
Repairs and maintenance:	2.59	2.12	1.63
Ponds	.25	.24	.25
Water supply	.34	.37	.39
Feeding equipment	.14	.10	.09
Disease, parasite, and weed control equipment	.04	.02	.01
Harvesting equipment	.24	.14	.07
Miscellaneous equipment	1.58	1.25	.82
Fuel:			
Pumping	3.21	3.49	3.67
Power, transportation feeding, harvest, etc.	1.55	1.42	1.45
Chemicals	.73	.80	.76
Fingerlings	11.87	13.21	13.89
Feed	49.76	55.35	58.14
Labor:			
Manager	6.99	3.85	3.20
Hired labor (full time)	6.99	5.02	3.23
Hired labor (for harvest)	.64	.70	.75
Interest on operating capital	2.84	2.89	2.92
TOTAL	100.00	100.00	100.00

Table 10. Monthly cash expenses, Farm Situation I, Delta of Mississippi, 1977.

Month	Feed	Chemicals	Labor	Fuel	Fingerlings	Repairs and Maintenance	Interest Paid	Taxes and Insurance	Total by Month
	dollars								
January			3,333			619			3,952
February			3,333	4,598		619			8,550
March	1,996	20	3,333	2,220	33,984	619			42,172
April	6,538		3,333	2,299		619			12,789
May	8,781	518	3,333			619			13,251
June	11,621	518	3,333			619			16,091
July	16,763	518	3,333	4,519		619			25,752
August	30,418	518	3,333			619			34,888
September	41,615		3,333			619			45,567
October	24,686		5,151			619	8,045		38,501
November			3,333			619			3,952
December			3,333			619		2,671	6,623
TOTAL	142,419	2,092	41,818	13,636	33,984	7,427	8,045	2,671	252,092

Table 11. Monthly cash expenses, Farm Situation II, Delta of Mississippi, 1977.

Month	Feed	Chemicals	Labor	Fuel	Fingerlings	Repairs and Maintenance	Interest Paid	Taxes and Insurance	Total by Month
	dollars								
January			3,833			915			4,748
February			3,833	9,058		915			13,806
March	4,142	39	3,833	3,680	68,592	915			81,202
April	14,234		3,833	4,529		915			23,511
May	18,578	1,024	3,833			915			24,350
June	24,178	1,024	3,833			915			29,950
July	34,110	1,024	3,833	8,209		915			48,091
August	60,936	1,024	3,833			915			66,708
September	82,139		3,833			915			86,887
October	46,162		7,455			915	14,869		72,403
November			3,833			915			4,748
December			3,833			915		3,437	8,185
TOTAL	287,479	4,135	49,622	25,476	68,592	10,980	14,869	3,437	464,592

Table 12. Monthly cash expenses, Farm Situation III, Delta of Mississippi, 1977.

Month	Feed	Chemicals	Labor	Fuel	Fingerlings	Repairs and Maintenance	Interest Paid	Taxes and Insurance	Total by Month
	dollars								
January			5,333			1,349			6,682
February			5,333	18,153		1,349			24,835
March	8,301	79	5,333	7,176	137,495	1,349			159,733
April	28,516		5,333	9,076		1,349			44,274
May	37,203	1,849	5,333			1,349			45,734
June	47,871	1,849	5,333			1,349			56,402
July	68,520	1,849	5,333	16,252		1,349			93,303
August	121,061	1,849	5,333			1,349			129,592
September	164,238		5,333			1,349			170,920
October	99,592		12,666			1,349	28,616		142,233
November			5,333			1,349			6,682
December			5,333			1,349		5,106	11,788
TOTAL	575,303	7,475	71,333	50,657	137,495	16,193	28,616	5,106	892,178

Table 13. Costs and returns from producing catfish with investment financed for five years, [1] Farm Situation I, Delta of Mississippi, 1977.

Item	1	2	3	4	5
	--------------	--------------	dollars	--------------	--------------
Principal and Interest[2]	76,853	76,853	76,853	76,853	76,853
Annual Operating Cost	252,092	252,092	252,092	252,092	252,092
Total Annual Cost	328,945	328,945	328,945	328,945	328,945
Revenue @ .58 per pound	380,355	380,355	380,355	380,355	380,355
Net Revenue	51,410	51,410	51,410	51,410	51,410
Revenue @ .50 per pound[3]	327,893	327,893	327,893	327,893	327,893
Net Revenue	-1,052	-1,052	-1,052	-1,052	-1,052

[1] The $291,334 investment requirement is financed for 5 years. The entire annual operating cost is financed annually.

[2] All loans were assumed to have a 10% annual interest rate.

[3] A price of $0.5016 causes revenue to equal cost.

Table 14. Cost and returns from producing catfish with 75% of investment financed for five years,[1] Farm Situation I, Delta of Mississippi, 1977.

Item	1	2	3	4	5
	--------------	--------------	dollars	--------------	--------------
Principal and Interest[2]	57,641	57,641	57,641	57,641	57,641
Operating Cost	189,069	189,069	189,069	189,069	189,069
Total Cost	246,710	246,710	246,710	246,710	246,710
Revenue @ 58¢/lb.	380,355	380,355	380,355	380,355	380,355
Net Revenue	133,645	133,645	133,645	133,645	133,645
Revenue @ 37¢/lb.[3]	242,640	242,640	242,640	242,640	242,640
Net Revenue	-4,070	-4,070	-4,070	-4,070	-4,070

[1] Seventy-five % of the $291,334 investment requirement is financed for 5 years. Seventy-five % of the annual operating cost is financed annually.

[2] All loans were assumed to have a 10% annual interest rate.

[3] A price of $0.3762 causes revenue to equal cost.

Gross revenue and the repay-ient potential for the different quity situations and repayment eriods were computed at 58 cents[6] er pound for catfish f.o.b. pond ank (the weighted average price aid by processors in 1977) and for rices decreased by 1-cent in-rements until revenues would not over costs.

Costs and returns to Farm Situaion I are presented for each equity ituation and payback schedule Tables 13, 14 and 15). The payback chedule presented in each table ncludes repayment of the initial nvestment in land, buildings and quipment and reinvestment in iachinery and equipment at the nd of their depreciable life.[7]

The 163 acre unit was the ighest-cost alternative considered n our study and payback chedules are more favorable for he larger operations. Most data equired for determining costs and eturns to the larger units are resented in this publication.

Returns above cost of production re positive for each equity situaion if catfish sell for 58 cents Tables 13, 14, and 15). Returns to a 63-acre operation with no equity nd a five-year repayment schedle are negative if catfish are priced elow 51 cents (Table 13). Returns o a 163-acre unit with a 25% equity nd a five-year repayment chedule are negative if catfish sell or less than 38 cents (Table 14). Cumulative net returns to a 163-cre operation with no equity and a ariable repayment schedule over 20-year period are negative if atfish are priced as low as 44 cents (Table 15), positive if catfish are priced at 46 cents. However, revenue does not exceed cost in some years if catfish are priced as low as 46 cents.

COST SENSITIVITY

Feed and fingerling costs comise 62, 69 and 72% of total annual costs for Farm Situations I, II and III, respectively. The rate of initial stocking is the determining factor in quantity of feed and number of

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[6] *Price data obtained from Mr. James W. Ayres, Marketing Specialist, National Marine Fisheries Service, ttle Rock, Arkansas.*

[7] *Results of this study should not be interpreted as recommendations. They are presented as a guide to oducers and lending agencies interested in financing catfish production.*

Table 15. Costs and returns from producing catfish with investment financed for three lengths of loans,[1] Farm Situation I, Delta of Mississippi, 1977.

Item	Years 1-5	6-7	8	9-10	11-12	13-15	16	17	18-19	20
	dollars									
Costs										
Operating	252,092	252,092	252,092	252,092	252,092	252,092	252,092	252,092	252,092	252,092
5 year loan[2]	2,722	2,722	2,722	2,722	2,722	2,722	2,722	2,722	2,722	2,722
7 year loan[3]	36,958	36,958	0	4,622	17,628	32,191	27,569	32,191	19,185	4,622
20 year loan[4]	11,069	11,069	11,069	11,069	11,069	11,069	11,069	11,069	11,069	11,069
Total Cost	302,841	302,841	265,883	270,505	283,511	298,074	293,452	298,074	285,068	270,505
Total Revenue @ 58¢/lb.	380,355	380,355	380,355	380,355	380,355	380,355	380,355	380,355	380,355	380,355
Net Revenue	77,514	77,514	114,472	109,850	96,844	82,281	86,903	82,281	95,287	109,850
Total Revenue @ 46¢/lb.	302,841	302,841	302,841	302,841	302,936	302,936	302,936	302,936	302,936	302,936
Net Revenue	0	0	37,048	32,426	19,425	4,862	9,484	4,862	17,868	32,431
Total Revenue @ 44¢/lb.[5]	288,545	288,545	288,545	288,545	288,545	288,545	288,545	288,545	288,545	288,545
Net Revenue	-14,296	-14,296	22,662	18,040	5,034	-9,529	-4,907	-9,529	3,477	18,040

[1] Schedule includes repayment of initial investment of $291,334 and reinvestment in machinery and equipment as these items are replaced in the inventory.

[2] The cost of the 5 year loan remains constant for every year in the analysis.

[3] The cost of the 7 year loan differs from year to year because of the difference in length of loan and life of the depreciable items.

[4] The cost of the 20 year loan remains constant for each year in the analysis.

[5] A price of $0.44389 causes cumulative revenue over the 20 year period to equal cumulative cost over the 20 year period.

fingerlings used. Therefore, sensitivity analysis was performed to determine the effect of selected changes in the rate of initial stocking on total costs of production.

Feed

The price of feed was varied by about 10 and 20% both above and below the base price of $263.78 per ton. A 10% change in feed price results in less than a 3-cent change in total cost per pound of production (Table 16).

Fingerlings

The price of fingerlings was varied by 10, 20 and 30% above and below the base price of 6 cents. A 10% change in fingerling price results in a very small change in total cost per pound of production (Table 17).

Table 16. Total cost per pound of harvested catfish for selected feed prices, three farm situations, Delta of Mississippi, 1977.

Price per ton of feed	Farm Situation I	II	III
	dollars		
208.56	.3844	.3526	.3328
236.17	.4166	.3748	.3550
263.78[1]	.4363	.3923	.3729
291.39	.4610	.4192	.3989
319.00	.4832	.4414	.4211

[1] **The base price of feed was $263.78 per ton. Other prices are 1 and 2 standard deviations above and below the base price or about 10 and 20% above and below the base price.**

Stocking Rates

Rates of initial stocking have a ignificant effect on per pound cost f production. The effects on costs f reducing the stocking rate from 000 to 3500 and 3000 fish per urface acre were analyzed for each farm situation (Table 18). Feed and fingerling costs were the only major cost components that changed. Each change (500 fish per surface acre) in the stocking rate changed total costs about 7.7%. Reducing the stocking rate reduces total cost but increases per pound costs. Conversely, an increase in stocking rate (e.g. from 3000 to 3500 per surface acre) increases total cost but reduces per pound cost.

Table 17. Total cost per pound of harvested catfish at selected fingerling prices, three farm situations, Delta of Mississippi, 1977.

	Farm Situation		
Price per Fingerling	**I**	**II**	**III**
	------------dollars------------		
.042	.4232	.3815	.3614
.048	.4284	.3867	.3666
.054	.4336	.3919	.3718
.060[1]	.4363	.3923	.3729
.066	.4439	.4022	.3821
.072	.4491	.4074	.3873
.078	.4543	.4126	.3925

[1] The base price of fingerlings was $.06 each. Other prices are 10, 20, and 30% changes above and below the base price.

Table 18. Total cost and cost per pound of harvested catfish at selected stocking rates, three farm situations, Delta of Mississippi, 1977.[1]

	Farm Situation		
Stocking Rate	**I**	**II**	**III**
	---------------dollars---------------		
	4000 fingerlings per surface acre		
Total Cost	286,192	519,280	989,465
Cost per pound	.4363	.3923	.3729
	3500 fingerlings per surface acre		
Total Cost	264,250	474,974	900,621
Cost per pound	.4605	.4101	.3879
	3000 fingerlings per surface acre		
Total Cost	242,259	430,590	811,649
Cost per pound	.4926	.4338	.4079

[1] Cost changes include changes in feed and fingerling costs only.

APPENDIX

Technical coefficients used in this study are a combination of recommendations of producers and professionals in the area of catfish production. The recommended practices used are not to be interpreted as "optimal" levels, but should serve as a guide for the industry.

The remainder of this section will be an attempt to outline the development of the technical coefficients that made up the basic production system.

Production System

The production system was designed to produce fish that average 1.25 pounds in 210 days. The growing season runs from March 15 through October 15.

Coefficients dealing with stocking rates, size of fingerlings stocked, feed conversion rates, mortality rate (including those that escape harvest), and total production per acre are estimates based on consultation with catfish producers and with professional workers in the area of catfish production.

Six-inch fingerlings weighing 1 ounce each insure production of a marketable fish in one growing season and make full use of the entire season.

The mortality rate, including those that escape harvest, of 5% is a collective opinion of producers and professional workers. This figure is considered to be readily attainable in light of the disease and parasite control and water quality programs assumed for the study.

There is no collective opinion as to the most appropriate stocking rate. For this study a stocking rate of 4000 fish per acre was chosen. This rate as well as rates higher and lower were reported by commercial operators. However, the average rate of stocking over the area is less than 4000 per surface acre of water.

The feed conversion ratio was 1.6 pounds of feed per pound of gain.

Pond Construction

The designs and coefficients for construction of ponds were developed in consultation with Soil Conservation Service personnel.[8] The farm design is common in the Delta of Mississippi. There are two basic assumptions underlying the development of pond construction coefficients. The first is that land for pond construction is available in square 160-acre tracts and the second is that the land is level or essentially so (0-2 percent slope). The latter assumption is a very practical one for several reasons. First, the Delta of Mississippi is characterized by a topography that fits this assumption. Second, SCS personnel report that coefficients developed under the level land assumption do not differ significantly from actual earth moving requirements encountered in construction. Third, this allows individuals to adapt the study to fit their particular situations.

All levees are of the same dimensions. The levees are designed to hold water at a minimum depth of four feet and a maximum depth of six feet with a two foot freeboard. A pond bottom slope of approximately 0.1 foot per 100 feet of run is incorporated into the levee coefficients. The levees have a side slope of 3:1 and a top width of fourteen feet. Earth moving requirements in this study are estimated to be 6.2 cubic yards per linear foot of levee run (Appendix Table 1).

The 160 and 320 acre farms were designed with drainage ditches on two opposite sides and the 640 acre tract was designed with drainage ditches on two opposite sides and a third ditch running down the

[8] *Mr. Tom E. Blaylock, District Engineer, Soil Conservation Service, Greenwood, Mississippi.*

center of the tract parallel to the other ditches. An allowance was made for an eight foot berm between the drainage ditches and the levees. Other studies have found this design efficient in land use and it provides for future firm expansion [6, 14].

The method of drainage used is referred to as the "gate and screen". Each pond is drained by a seventy-five foot length of 16 inch pipe fitted with a gate and screen.

A layer of standard road gravel four inches deep and eight feet wide on three levees of each pond to insure access to the ponds in all types of weather was included in cost estimates. Under these specifications, one cubic yard of gravel will cover ten linear feet of levee run (Appendix Table 2). Appendix Figure 1 presents schematics of farm designs, pond design, and cross section of levee, berm, and ditch.

Erosion of levees is a major problem. To help prevent this deterioration, all exposed portions of each levee require vegetative cover that is maintained annually. The area of exposed levee was treated as fescue pasture to develop a charge for establishment and maintenance of vegetative cover [19]. These coefficients are shown in Appendix Table 3.

Appendix Table 1. Estimated linear feet of levee run, cubic yards of earth per linear foot of levee, and total volume of earth moved, three farm situations, Delta of Mississippi, 1977.

Farm Situation	Linear feet of levee run	Cubic yds. per linear ft.	Total volume of earth moved
			--cubic yards--
I	20,176	6.2	125,091.2
II	37,944	6.2	235,252.8
III	75,996	6.2	471,175.2

Appendix Table 2. Linear feet of levee requiring all-weather surfacing and total cubic yards of gravel, three farm situations, Delta of Mississippi, 1977.

Farm Situation	Linear feet of levee	Total volume of gravel
		--cubic yards--
I	15,260	1,526
II	29,040	2,904
III	56,280	5,628

Appendix Table 3. Land requiring vegetative cover, and establishment cost, three farm situations, Delta of Mississippi, 1977.

Farm Situation	Land	Cost
	acres	dollars
I	10.1	933.04
II	17.52	1618.50
III	34.96	3229.60

[1]Annual Maintenance costs is $70.50 per acre.

Water Supply

Wells were selected as the source of water. The operations are dependent on a supply of readily available water that is free of undesirable fish and other pollutants. After viewing the capacity of many on-going operations and determining requirements for water during stress periods it was concluded that one 3000 g.p.m. well could supply the needs of four ponds (80 land acres). This would give a total capacity of approximately 43 g.p.m. per surface acre. Estimated investment and ownership costs are presented in Appendix Tables 4 and 5.

Diesel was chosen as the fuel source. Other fuels are being used but the choice of the majority of producers was diesel. In any given situation one of the other fuels: butane, electricity, or gasoline could be the least cost alternative, but this decision must be made individuals after analysis of th particular situations.

The fuel consumption rate for t 3000 g.p.m. well was estimated 3.698 gallons per hour of pumpi time. This estimate was develop in consultation with Mr. Francis Rhodes.[9] Water requirements w converted to hours of pumping ti (Appendix Table 6).

Water requirements for t

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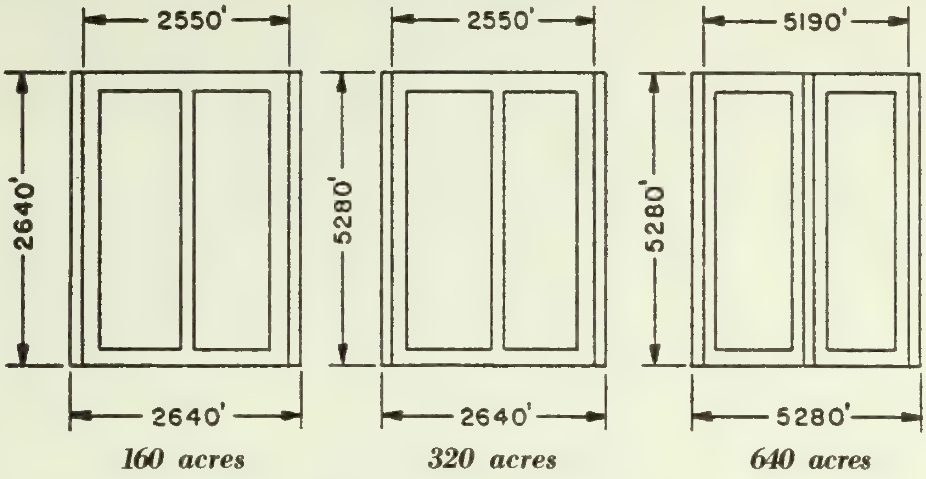
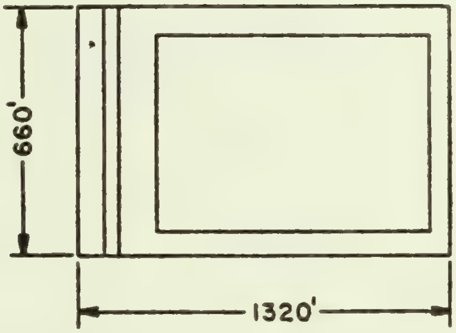
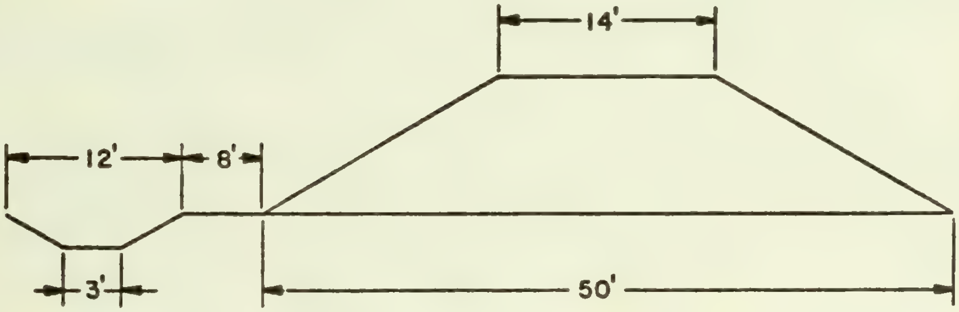
[9] *Francis E. Rhodes is a Teaching Research Assistant in the Department of Agricultural and Biologi Engineering, Mississippi State University.*


2550'
2550'
5190'
2640'
5280'
5280'
2640'
2640'
5280'
160 acres
320 acres
640 acres

Farm design and layout of drainage structures for the three farm situations



Specifications for a 20 land acre pond



Levee specifications and design of ditch and berm

Appendix Figure 1. Schematics of farm designs, pond design and cross section of levee, berm and ditch.

initial filling of ponds were calculated by standard engineering procedures. Data on pan evaporation by month were converted to pond surface evaporation at a rate of .70 and correlated with monthly precipitation data [15, 22].[10] In those months in which evaporation exceeds precipitation the difference must be replaced. Twenty-two % of the initial volum must be replaced in May, 38% i June, 54% in July, 53% in August 52% in September, and 21% i October.

Feeding

A majority of producers fed floating feed which contained 35% protein. Recommendations on feeding rates were given as 3 to 5% of body weight per day under normal conditions. The feeding program incorporates the initial weight of the fingerlings stocked and the 1.6:1 feed conversion ratio in determining weekly feed requirements.

Feeding is accomplished through the use of a p.t.o. driven fish feeder. The hopper capacity is 2000 pounds and the calibrated discharge has a maximum weight of 200 pounds. Specifications for the feeder show that it is adequate for Farm Situations I and II, but two feeders must be incorporated into Farm Situation III to meet the requirements during the later part of the growing season. Bulk storage bins are provided for storing the feed. The bins are the gravity flow design with a 23-ton capacity. One bin is included in the program for Farm Situation I. Farm Situation II has two bins and Farm Situation III has three bins. The storage capacity shown for each situation will hold as much as a six-day supply early in the growing season, and at least a two-day supply in the latter part of the season. This is no unlike many actual operations.

Appendix Table 4. Estimated investment for a 3000 gallon per minute well,[1] Delta of Mississippi, 1977.

Item	Cost
	dollars
Well and casing	
casing - 60′ x 16″ @$15.11/ft.	900.00
screen - 40′ x 16″ @$17.50/ft.	700.00
gravel - 20 yds. @$20.00/yd.	400.00
drilling and labor	1,500.00
Subtotal	3,500.00
Pump and Engine	
pump assembly	4,800.00
suction and discharge pipe	225.00
right angle gear drive	1,200.00
diesel engine	4,500.00
spicer shaft	150.00
fuel tank (500 gal.)	200.00
Subtotal	11,075.00
TOTAL	14,575.00

[1] The wells are 100 feet deep. The depth to the screen is 60 feet. The pump is a two stage turbine driven by a 60 h.p. diesel engine. The rate of flow is 3000 gallons per minute, with 68 feet of head.

Source: Mr. Max Harper, Butane Gas Company of Greenwood, Mississippi.

Disease, Parasite and Weed Control

The disease, parasite, and weed control program was set up to address those problems that a producer in Mississippi could expect to encounter. All or none of these problems may arise. In the latter case, the producer would not be faced with all the costs estimated. However, the management system assumed for this study allows for such costs.

To conform to the assumption of a high level of management, cost estimates for particular practices and pieces of equipment were included in total costs. The practices included were frequent oxygen determination, especially at night, and careful observation of the activities of the fish in order to detect early symptoms of stress and/or disease problems. These practices assume that the manager possesses the necessary skills to recognize early symptoms. To ai the manager in carrying out h program there are several pieces necessary equipment. Each far situation is equipped with a oxygen meter and probe to be use in oxygen checks, and a boat, fitte with a chemical mixing ar application chamber, for disea and weed control. The boat powered by a 10 h.p. motor and standard boat trailer is provide

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[10] *The recording station for these data is located at Scott, Mississippi.*

The disease, parasite and weed ontrol program includes: (1) *ingerling treatment using formalin.* Treatment is accomplished y placing fingerlings in a vat ontaining 250 p.p.m. formalin for ne hour. The amount of formalin equired was 3.89 gallons, 7.88 allons, and 15.79 gallons for ituations I, II, and III, respectively. (2) *Parasite treatment.* This reatment was administered twice nnually on 20% of the ponds. otassium permanganate was sed at rates of 1922.4 pounds, 3888 ounds, and 6819.2 pounds for arm Situations I, II and III, espectively. Treatment of acterial infections was accomplished using Terramycin (TM-00) added to the feed. (3) *Weed ontrol.* This treatment was administered once annually on 75% of he ponds. Copper sulfate and armex both were incorporated nto the program. Quantities of opper sulfate used were 720.9 ounds, 1396.4 pounds, and 2922.48 ounds for Farm Situations I, II nd III respectively. Karmex was sed at a rate of 26.7 pounds for arm Situation I, 54 pounds for arm Situation II, and 108.24 ounds for Farm Situation III. etails of these programs are eported in Appendix Table 7.

Harvesting

The harvesting technique incor-orated into the cost estimates is ne in use by many producers in the Mississippi Delta area. The system mployes two tractors, one pulling seine reel and the other anchoring the free end of the seine, position and haul the seine. This ystem adapts well to the overall peration in that it does not violate ny of the restrictions placed on bor or equipment availability.

Coefficients for the system were eveloped in consultation with ersonnel of the U. S. Fish and ildlife Service, Fish Farming xperiment Station, Stuttgart, rkansas, and were tested for

Appendix Table 5. Estimated annual ownership and operating cost for a 3000 gallon per minute well, Delta of Mississippi, 1977.

Item	Cost
	dollars
Ownership cost	
Depreciation[1]	
well and casing	233.33
pump assembly	400.00
suction and discharge pipe	18.75
right angle gear drive	100.00
spicer shaft and flanges	12.50
fuel tank	10.00
diesel engine	562.50
Interest	
well and casing	157.50
pump assembly	216.00
suction and discharge pipe	10.13
right angle gear drive	54.00
spicer shaft and flanges	6.75
fuel tank	9.00
diesel engine	202.50
Operating Cost[2]	
repairs and maintenance[3]	437.25
TOTAL SPECIFIED COST	2,430.21

[1] Depreciation schedule was adopted from Foster and Waldrop, Cost-size Relationships in the Production of Pond-Raised Catfish for Food (Bulletin 792, Mississippi State University, Mississippi Agricultural and Forestry Experiment Station, January 1972). Wells and casing, 15 years; pump assembly, 12 years; suction and discharge pipe, 12 years; right angle gear, 12 years; spicer shaft and flanges, 12 years; fuel tank, 20 years; diesel engine, 8 years.

[2] Charges for fuel are presented in Table 7.

[3] Estimated at 3 percent of investment per year.

Appendix Table 6. Estimated total hours pumping time and diesel fuel required, three farm situations, Delta of Mississippi, 1977.

Farm Situations	Hours of Pumping Time	Fuel Consumption
		gallons
I	4,521	16,720
II	8,907	32,938
III	17,850	66,009

Appendix Table 7. Basic disease, parasite, and weed control program, three farm situations, Delta of Mississippi, 1977.

Item	Frequence of Occurrence	Ponds Requiring Treatment	Possible Treatment
		percent	
Fingerling treatment	Annually at stocking	100	250 P.P.M. formalin for one hour
Parasite incidence	Twice annually	20	2 P.P.M. of potassium permanganate
Bacterial incidence	Twice annually	20	Maintain feeding schedule with feed treated with TM-100 for 10 days.
Weed control	Once annually	75	One half of acreage with copper sulfate at 1 P.P.M. and one half of acreage with Karmex at .5 lb. per surface acre.

accuracy through observation of the harvesting process on several commercial operations. The labor required for harvesting is presented separately. The coefficients are for a trained harvesting crew. Harvesting equipment for each Farm Situation includes 2000 feet of haul seine, a brailing basket, a 20,000-pound and a 10,000-pound capacity live car, a crane with 17-foot reach, a seine storage reel, and 50 feet of cutting seine.

With the advances made in the catfish processing industry it is possible to move from 40,000 to 50,000 pounds of fish a day through the plants. This allows the fish to be moved from one 20 land acre pond with only a portion of the fish held overnight in live cars.

It is assumed that 90% of the fish are captured on the first sweep and the remaining fish are removed on the second sweep. Some fish likely will be left in the ponds, but for purposes of this study were included in the 5% mortality rate. Estimated labor requirements for harvesting are presented in Appendix Tables 8-11.

Appendix Table 8. Estimated labor requirements for harvesting a 20 acre pond, by operation, Delta of Mississippi, 1977.

Operation	Time per Operation	Number in Crew
	hours	
1. Preliminary Equipment Check	1	1
2. Lower Seine into water and prepare to pull	1	5
3. Attach live car	.083	2
4. Pull Seine	1.75	5
5. Detach 1st live car and attach 2nd live car	.167	2
6. Load fish/1000#	.085	5
7. Maintenance of fish overnight	8	1
8. Second Seine pull (sum of items 2-4 above)	2.83	5
9. Loan fish/1000#	.085	5
10. Cleanup, gear maintenance, and storage/100 ft. of seine	1	2

Appendix Table 9. Estimated total labor requirements for harvesting a 160 acre farm, by operation, Delta of Mississippi, 1977.

Operation	Hours Per Operation	Number in Crew	Total Man Hours
1. Preliminary equipment check	8	1	8.0
2. Lower seine into water and prepare to pull	8	5	40.0
3. Attach live car	.664	2	1.328
4. Pull seine	14	5	70
5. Detach live car & attach second live car	1.336	2	2.672
6. Load fish (40,000 lbs./pond)	27.2	5	136.0
7. Maintenance of fish overnight (eight nights)	64.00	1	64.0
8. Second seine pull (sum of 2-5)	23.6242	5	118.0
9. Load fish (335,785 lbs.)	29.97	5	149.86
10. Cleanup, gear maintenance and storage	8	2	16.0
TOTAL	194.79	---	605.86

Appendix Table 10. Estimated total labor requirements for harvesting a 320 acre farm, by operation, Delta of Mississippi, 1977.

Operation	Hours Per Operation	Number in Crew	Total Hours
1. Preliminary equipment check	16	1	16.0
2. Lower seine into water and prepare to pull	16	5	80.0
3. Attach live car	1.328	2	2.656
4. Pull seine	28.0	5	140.0
5. Detach live car and attach second live car	2.672	2	5.344
6. Load fish (40,000 lbs/pond)	54.4	5	272.0
7. Maintenance of fish overnight (16 nights)	128.0	1	128.0
8. Second seine pull (sum of items 2-4)	45.328	5	226.64
9. Load fish (683,611 lbs.)	60.98	5	304.89
10. Cleanup, gear maintenance and storage	16	2	32.0
TOTAL	368.708	---	1207.53

Appendix Table 11. Estimated total labor requirements for harvesting a 640 acre farm, by operation, Delta of Mississippi, 1977.

Operation	Time per Operation	Number in Crew	Total Man Hours
1. Preliminary equipment check	32	1	32.0
2. Lower seine into water and prepare to pull	32	5	160.0
3. Attach live car	2.656	2	5.312
4. Pull seine	56.0	5	280.0
5. Detach live car and attach second live car	5.344	2	10.688
6. Load fish (40,000 lbs/pond)	108.8	5	544.0
7. Maintenance of fish overnight (32 nights)	256	1	256.0
8. Second seine pull (sum of items 2-4 above)	96.0	5	480.0
9. Load fish (1,373,243 lbs.)	122.47	5	612.34
10. Cleanup, gear maintenance and storage	32	2	64.0
TOTAL	743.27	---	2444.34

Appendix Table 12. Prices of selected inputs used in producing catfish for food, Delta of Mississippi, 1977.

Item	Unit	Price Dollars
Fingerlings	each	.06
Feed	ton	263.78
Gravel	cubic yards	4.29
Pipe		
Water Supply	linear foot installed	10.00
Drainage	linear foot installed	16.00
Chemicals		
Formalin	gallon	5.00
Potassium permanganate		
550 lb. drum	each	397.00
110 lb. drum	each	85.00
Copper Sulfate	100 lb. bag	53.00
Karmex	pound	2.30
Hired labor (part-time)	hour	3.00
Diesel	gallon	.55
Earth Moving	cubic yard	.40
Vegetative Cover		
Establishment cost	acre	92.38
Annual maintenance	acre	70.50
Tractors	each	17,000.00
½ ton truck	each	4,800.00
1½ ton truck	each	7,000.00
Relift pumps	each	2,635.00
Gate and screen	each	150.00

Appendix Table 13. Data used in estimating selected equipment and facility costs, Delta of Mississippi, 1977.

Item	Description	Estimated New Cost	Repairs as Percentage of New Costs	Estimated Life	Average Investment
Seine storage reel	2000′ capacity	$ 750.00	50	10	$ 375.00
Boat & motor	Standard capacity	1,230.00	75	10	615.00
Boat trailer	Standard capacity	270.00	40	10	135.00
Crane (backbone)	17′ reach	6,000.00	100	10	3,000.00
Feeder	2000# capacity	4,120.00	75	10	2,060.00
Feed storage service	23 ton capacity	1,900.00	50	10	950.00
Building	18′ x 42′	16,000.00	100	20	8,000.00
Relift pump	pto driven 16″ highlift	2,630.00	50	10	1,315.00
Tractor	90-100 hp	17,000.00	65	12	8,500.00
Mowing machine	6′ side mount	2,100.00	40	12	1,050.00
Haul seine with funnel & hoop	2000 section of 10′ seine w/ 1″ mesh	4,700.00	dollars per unit 120.00	5	2,350.00
Cutting seine	50′ section of 6′ seine w/ ½″ mesh	138.00	dollars per unit 7.00	5	69.00
Live car	20,000# capacity	250.00	dollars per unit 16.00 per car	5	125.00
Live car	10,000# capacity	170.00	dollars per unit 11.00 per car	5	85.00
Brailing basket	450 capacity	60.00	dollars per unit 3.00	5	30.00
Truck	½ ton	4,500.00	70	8	2,250.00
Truck	1½ ton	7,000.00	70	10	3,500.00
Oxygen meter and probe		600.00	5	5	300.00
Fiberglas transport tank	275 gal. capacity	400.00	10	5	200.00
Shop equipment		4,000.00	50	5	2,000.00

Miscellaneous

Each of the farm situations requires a storage and service building. Design of the facility came from the study done by Foster and Waldrop [6, p. 50]. The building is 18 feet wide and 42 feet long and contains an area for office space, chemical storage and a service or repair area equipped with those tools necessary to handle normal farm needs. This building is situated on he three acre service area assumed available on each farm. This plot of land also is used for access roads, parking, equipment storage, and bulk feed storage.

All tractors used in this study are n the 90-100 h.p. range, the size necessary to power the 16 inch p.t.o.-driven relift pumps. Each ituation is assumed to have one relift pump for each tractor. Farm Situation I is equipped with three tractors and relift pumps, Farm Situation II has four tractors and relift pumps, and Farm Situation III has six tractors and relift pumps. One tractor in each situation is assumed to be second hand. These "used" tractors are valued at one-half the estimated cost of new tractors.

One ½-ton pickup truck is assumed to be adequate for Farm Situations I and II, but two pickups are necessary for Farm Situation III. Each farm situation is assumed to have the services of a 1½-ton truck for heavier jobs.

Each farm situation was assumed to have a service and repair shop equipped with an electric welder, oxyacetylene torch, and other general shop equipment.

One 6-foot side-mounted mower was considered adequate for Farm Situations I and II, but two mowers were required for Farm Situation III.

Each farm was equipped with a 275-gallon capacity fiberglass transport tank.

Prices of selected inputs are presented in Appendix Table 12.

The data used in calculating depreciation and interest on investment for each piece of machinery and each building are presented in Appendix Table 13. Charges for each segment of the operation, such as harvesting and feeding, were computed by summing the charges for each item of equipment within that segment. Depreciation

Appendix Table 14. Estimated annual ownership and operating cost of selected equipment and facilities, Delta of Mississippi, 1977.

Item	Size or Description	Depreciation	Interest	Fuel	Repairs and Maintenance	Total
		dollars				
Seine storage reel	2000′ capacity	75	34		38	146
Boat and motor	16′ boat-10 h.p. motor	123	62	30	92	307
Boat trailer	std. commercial	27	14		11	51
Crane	17′ reach	600	300		600	1,500
Cutting seine	50′ section of 6′ seine with ½″ mesh	28	7		7	42
Live car	20,000 lb capacity	50	13		16	79
Live car	10,000 lb capacity	34	9		11	54
Brailing basket	450 lb capacity	11	3		4	18
Feeder	2000 lb capacity	412	206		309	927
Feed storage	bulk 23 ton capacity	190	95		95	380
Service building	18′ x 42′	800	800		800	2,400
Relift pump	p.t.o. driven-16″ high lift	263	132		132	526
Tractors	90-100 h.p.	1,417	850		921	3,185
Truck	1½ ton	700	350	325	490	1,865
Truck	½ ton	563	225	346	316	1,510
Mowing machine	6′ side mount	175	105		219	499
Haul seine and funnel hoop	2000′ section of 10′ seine with 1″ mesh	940	212		190	1,342
Oxygen meter and probe		120	30		30	180
Scales	1000# capacity	90	45		45	180
Fiberglas transport tank	275 gal. capacity	80	18		8	106
Shop Equipment		800	180		400	1,380

and interest charges for each item of equipment are presented in Appendix Table 14.

The costs of selected miscellaneous items needed to adjust cost estimates to correspond to individual situations, and n reported elsewhere in the study, a presented in Appendix Table 15

Appendix Table 15. Cost of selected miscellaneous items used in producing catfish for food, Delta of Mississippi, 1977.

Item	Farm Situation I	Farm Situation II	Farm Situation III
	dollars		
Insurance	2296	2694	3627
Fuel for relift pumps	362	844	2351
Formalin (@ $25/5 gal cont.)	25	50	100
Potassium permanganate	1448	2855	4938
Copper sulfate	530	1060	2067
Karmex	90	170	370

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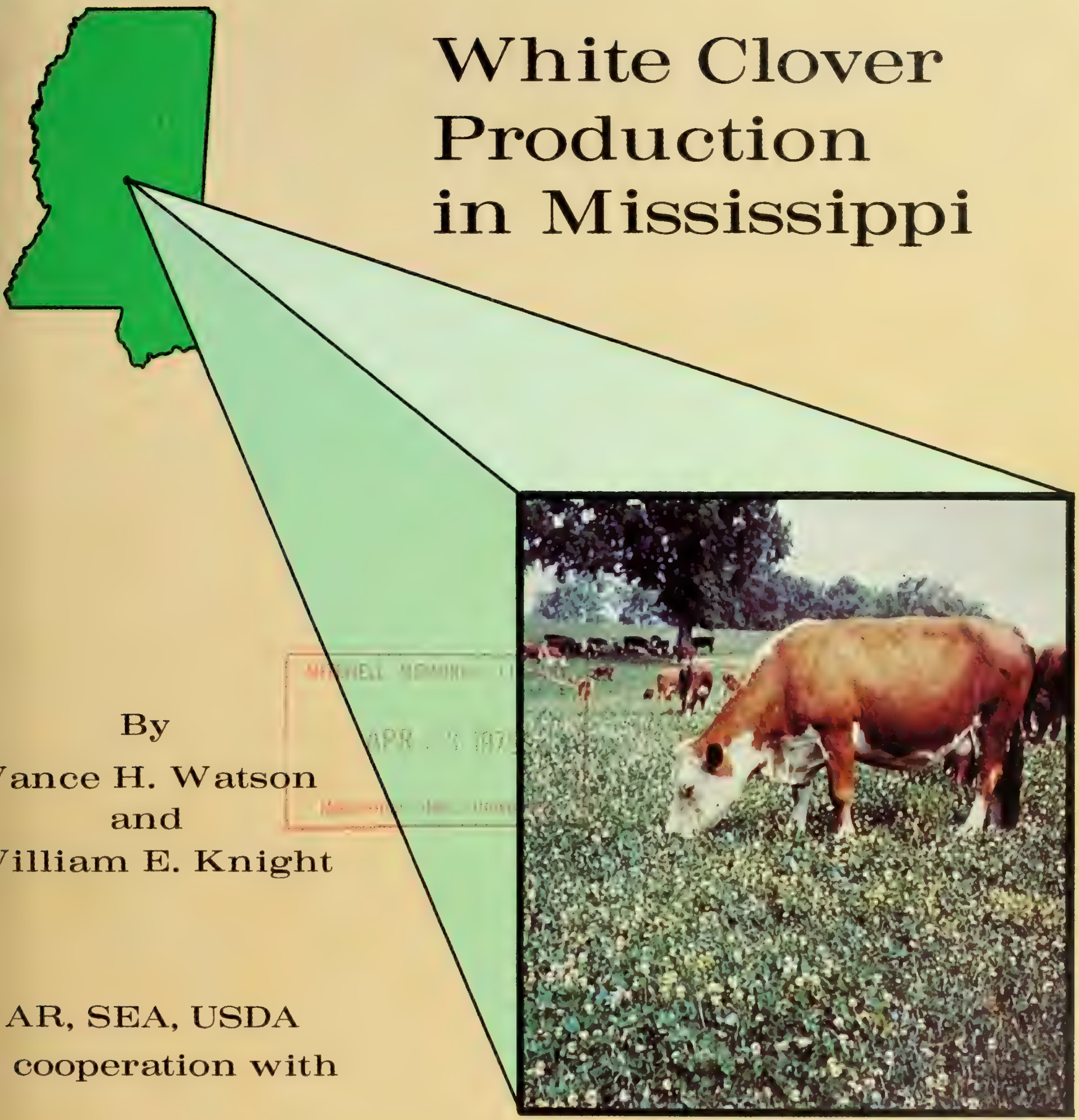
White Clover Production in Mississippi



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Value of Clovers in Producing Milk and Beef

Browning (1) used lactating dairy cows to determine relative quality and production of irrigated pastures. Cows produced more milk year-round on pastures where clover furnished nitrogen than on heavily fertilized grass. Forage quality and production of ladino clover and ladino overseeded on Coastal bermudagrass with no added nitrogen were compared with those from Coastal fertilized with 500 lbs of ammonium nitrate per acre. Cows grazing the ladino clover for an entire year produced 61% more milk per acre than those grazing the fertilized Coastal. The Coastal-clover mixture produced 32% more milk per year than the Coastal. The Coastal-clover mix produced less dry matter than the fertilized Coastal from May 13 to Sept. 13, and milk production per acre on the mix was only 90% of that on the grass because of reduced carrying capacity. However, milk production per cow was higher on the Coastal-clover mix.

Hogg and Collins (5) reported that the cost of beef production on Louisiana S-1 white clover overseeded on Coastal bermudagrass was lower than for other overseeded legumes, and considerably lower than on Coastal alone fertilized with nitrogen. Hogg (4) reported later that no economic yield response can be expected from applying nitrogen to mixtures of clover and Coastal bermudagrass. Pund and Hogg (15) concluded that steers grazing irrigated Coastal bermudagrass-clover pastures produced higher average daily gains and more beef per acre at lower cost than those grazing irrigated and fertilized Coastal bermudagrass without clover.

Annual clovers have been used satisfactorily in the Southern region of the United States to extend the grazing season, increase forage production, improve forage quality and improve use of land resources (3, 9, 10, 11, 12, 13). Based on recent results (25) it may be both economical and practical to use perennial species of clover as annuals when seed of annuals are not available, or prices are prohibitive. This practice permits maximum benefits of forage production without consideration of management for stand longevity and persistence. Also, it is necessary to have both annual and perennial clovers if a clover-grass mix is desired on a 12-month basis. This can be accomplished by using red or white clover in conjunction with annual clovers.

White clover (*Trifolium repens* L.) is the most important perennial clover used for pasture in Mississippi. The first cultivation of white clover from seed was begun in the Netherlands in the latter half of the sixteenth century, and white clover was introduced into the United States by colonists from Europe. Livestock producers throughout its area of use recognize the many values of white clover as part of a pasture mixture. In addition to fixing nitrogen, its high forage quality throughout the year supplements the lower quality of grasses, resulting in improved animal performance through higher average daily gains, higher conception rates, higher calf crop percentages, improved milk flow and better herd health.

White clover is classed botanically as a perennial legume with prostrate growth habit, and a typical plant is composed of a short primary stem that gives rise to stolons (runners) six to eight weeks after germination (Figure 1). Taproots may reach a depth of 3 feet or more in the second year; however, the primary root usually dies in the second year and roots from the stolons then sustain the plant.

There is a great range in size of plants and plant parts within the white clover species. Leffel and Gibson (4) reported that larger white clover plants may be more than 1 square yard in area and 12-18 inches tall. The predominantly white flower color, sometimes with a pinkish hue, is responsible for the common name of the species. The round flower heads are composed of 20 to 150 individual perfect flowers. Flowering is enhanced by the long days and optimum temperatures for growth following the short days and low temperatures of winter.

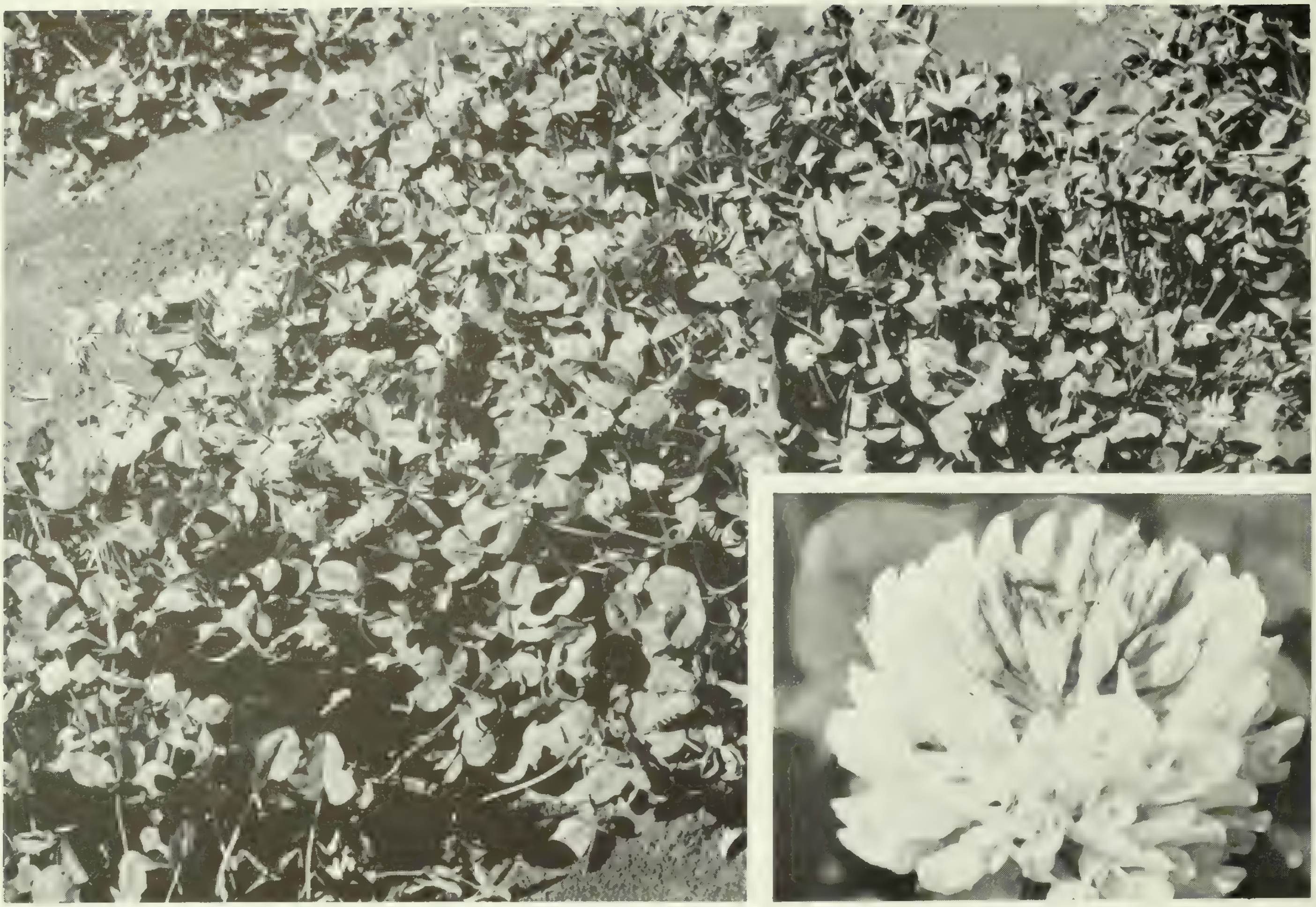

Figure 1. Typical white clover plant with numerous stolons (runners) and taproot system. Inset: Round head of white clover showing numerous perfect florets.

GUIDELINES FOR PRODUCING WHITE CLOVER

Soil Selection

White clover is best adapted to well-drained silt loam and clay soils with a pH of 6.0 to 7.0, but can be grown on sandy soils with adequate soil moisture and fertility.

Fertilization

Soils should be tested for pH, phosphate and potash[1]. Apply lime to bring the pH to 6.0 or above before planting. Apply phosphate and potash to bring levels to medium or above.

Seedbed Preparation

A firm, moderately smooth seedbed is essential because white clover seed are small and may be buried too deeply if planted on a loose seedbed. The prepared seedbed should be rolled with a corrugated roller or other firming device before seeding.

Varieties

'Regal,' 'Louisiana S-1,' 'Arcadia,' 'Tillman' and 'Nolin's Improved' are recommended varieties for Mississippi. Regal, Tillman and Arcadia are ladino types. Louisiana S-1 and Nolin's Improved are intermediate types. Summer production of Louisiana

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[1] *In the absence of a soil test, refer to the latest Crop and Fertilizer Guideline for Mississippi. Your county agent has these, and they are available from MAFES Editorial Department, Mississippi State, MS 39762.*

S-1 and Nolin's Improved is below hat of other recommended varieties, but they are recommended because of superior reseeding ability.

Inoculation

Inoculate seed with the proper strain of *Rhizobium* immediately before planting. Inoculation is accomplished easily by placing up to 25 lbs of seed in a tub or other large container (Figure 2), adding enough sticking solution (sugar or syrup solution or commercial sticker) to dampen the seed and applying the inoculum while stirring the seed. Stirring should continue until each seed is coated and the seed do not stick together.

Table 1. Estimates of nitrogen fixed by selected legumes.

Legume	**Nitrogen Fixed per acre**
	lbs
Alfalfa	194
White Clover	179
Red Clover	114
Crimson Clover	94
Lespedeza	85
Vetch	80

Each acre of land has about 35,000 tons of free nitrogen in the air above it, and producers can take advantage of the nitrogen by growing legumes inoculated with the proper strain of *Rhizobium* (Figure 3). It is not possible to determine exactly how much nitrogen is fixed by the bacteria in the nodules on legume plant roots; however, different investigators have reported that white clover may fix up to 180 lbs per acre (Table 1).

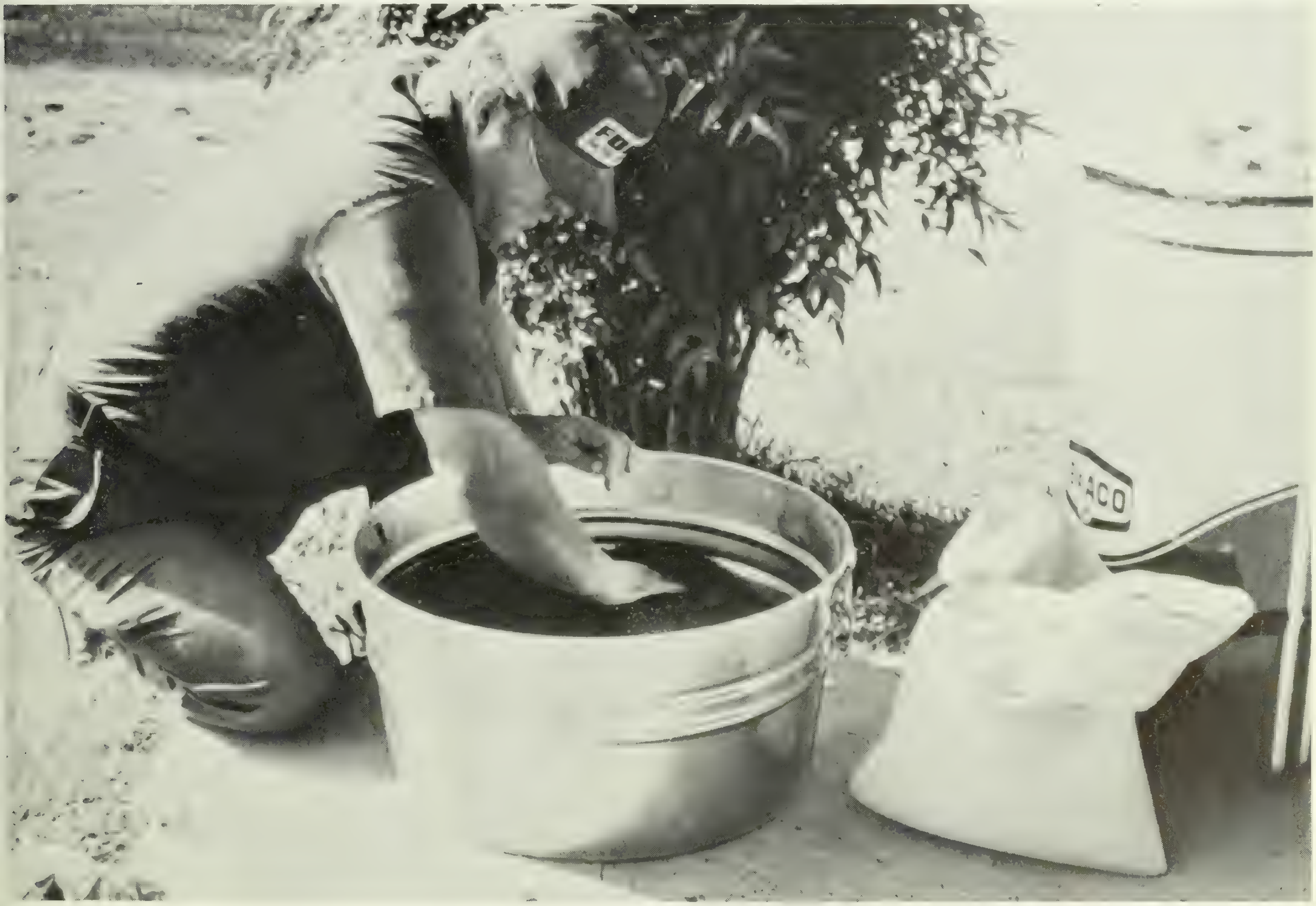

Figure 2. Sticking inoculant to the seed with sugar or syrup solutions or commercial stickers is essential to successful production of white clover. Apply just before planting to 25 pounds of seed or less at a time.

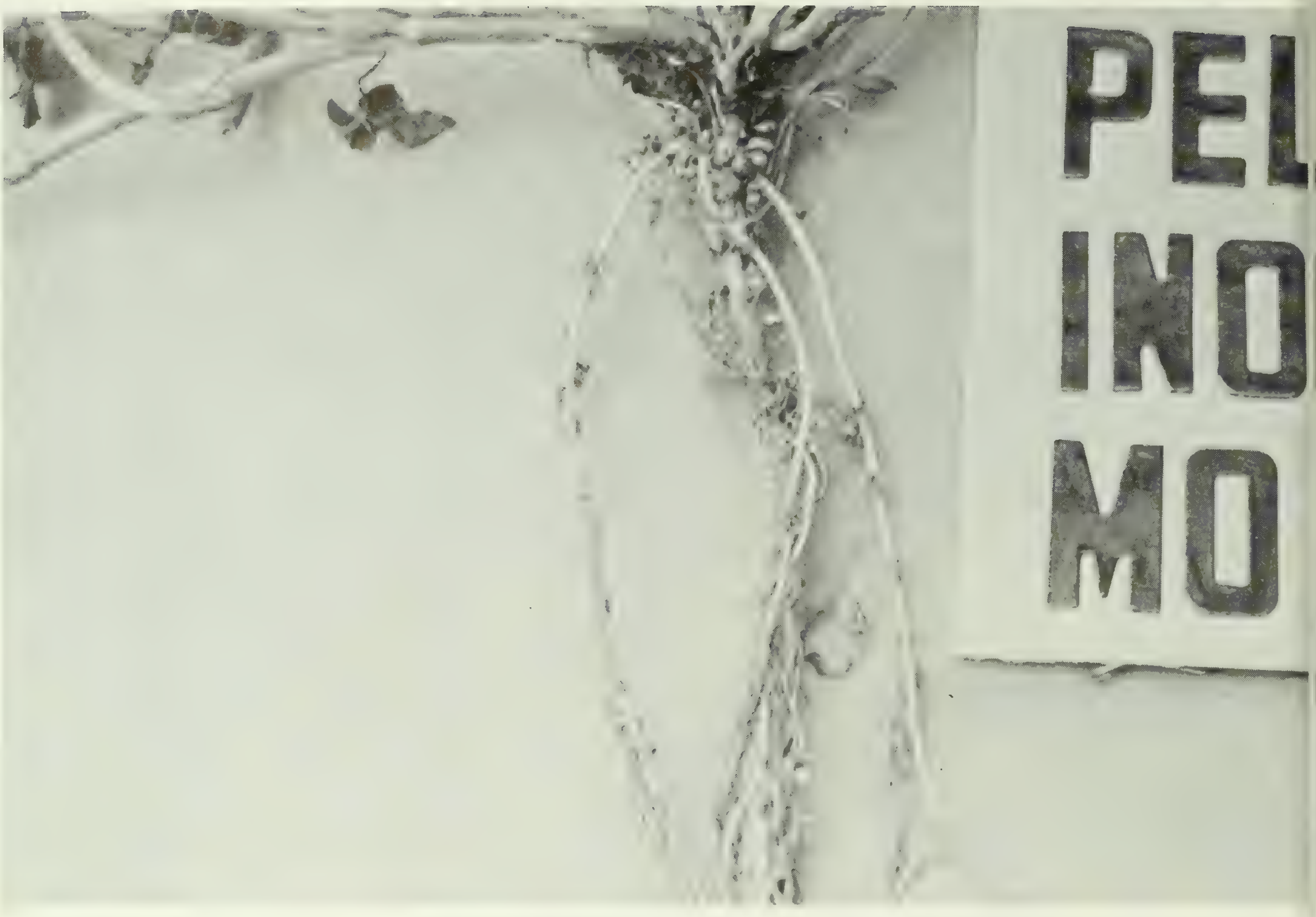

Figure 3. Root system of White Clover plant showing nodules containing nitrogen fixing bacteria. Nodules are active if the internal tissue is pink or red.

The cost of inoculation for 1 bushel of clover seed is about 90 cents. This will inoculate enough white clover seed for planting several acres.

Planting

White clover normally is planted one fourth-inch deep at 3lbs of seed per acre in September and October. It can be planted as a pure stand but most producers prefer to grow it in combination with dallisgrass, tall fescue or the bermudagrasses (Figure 4).

Topseeding white clover into existing sods of dallisgrass, tall fescue or bermudagrass as a practical means of introducing it into grass sods is gaining in popularity as a way to provide high-quality, low-cost grazing in winter and spring. Practices include overseeding grass sods without soil preparation; seeding with various types of sod planters; or seeding in combination with varying degrees of sod disturbance by disk harrows, chain harrows and/or pasture renovators.

Table 2. Average dry matter yield of five varieties of white clover planted alone on a prepared seedbed or topseeded into tall fescue or Coastal bermudagrass with no nitrogen added.

Method of Seeding	Dry Matter Yield 1968	Dry Matter Yield 1969
	--------Lbs/A--------	
Prepared Seedbed	4030 c[1]	2752 c
Topseeded into Coastal	6169 a	4926 a
Topseeded into Tall Fescue	4985 b	3009 b

[1]Means in a column followed by a different letter differ at the 5% level of probability.

Advantages of topseeding are that (1) cost is lower than for planting on a prepared seedbed, (2) no additional land is required for producing clover grass mixes, (3) wetter soils can be grazed, (4) the requirement for stored feeds is reduced, (5) labor required for daily feeding is reduced and (6) high-quality forage is produced in winter and spring without applying commercial nitrogen.

Research with white clover topseeded into Coastal bermudagrass and tall fescue with no nitrogen applied has demonstrated that both clover-grass mixes produce more dry matter than clover alone (Table 2). The Coastal-white clover was more productive than the fescue-white clover, and all yield differences were significant at the 5% level of probability.

Disadvantages of topseeding are that some seeding may be required each year, and there usually will be a lack of grazing in fall and early winter.

Weed Control

Weed control in white clover begins with use of good cultural practices such as using clean seed, fallowing, and planting at the proper time in fields that have low weed populations. Use of herbicides for controlling weeds in white clover has been limited; however, 2,4-DB applied at 0.5 to 1.0 lb per acre will control most broadleaf weeds if applied before the weeds are 3 inches tall.

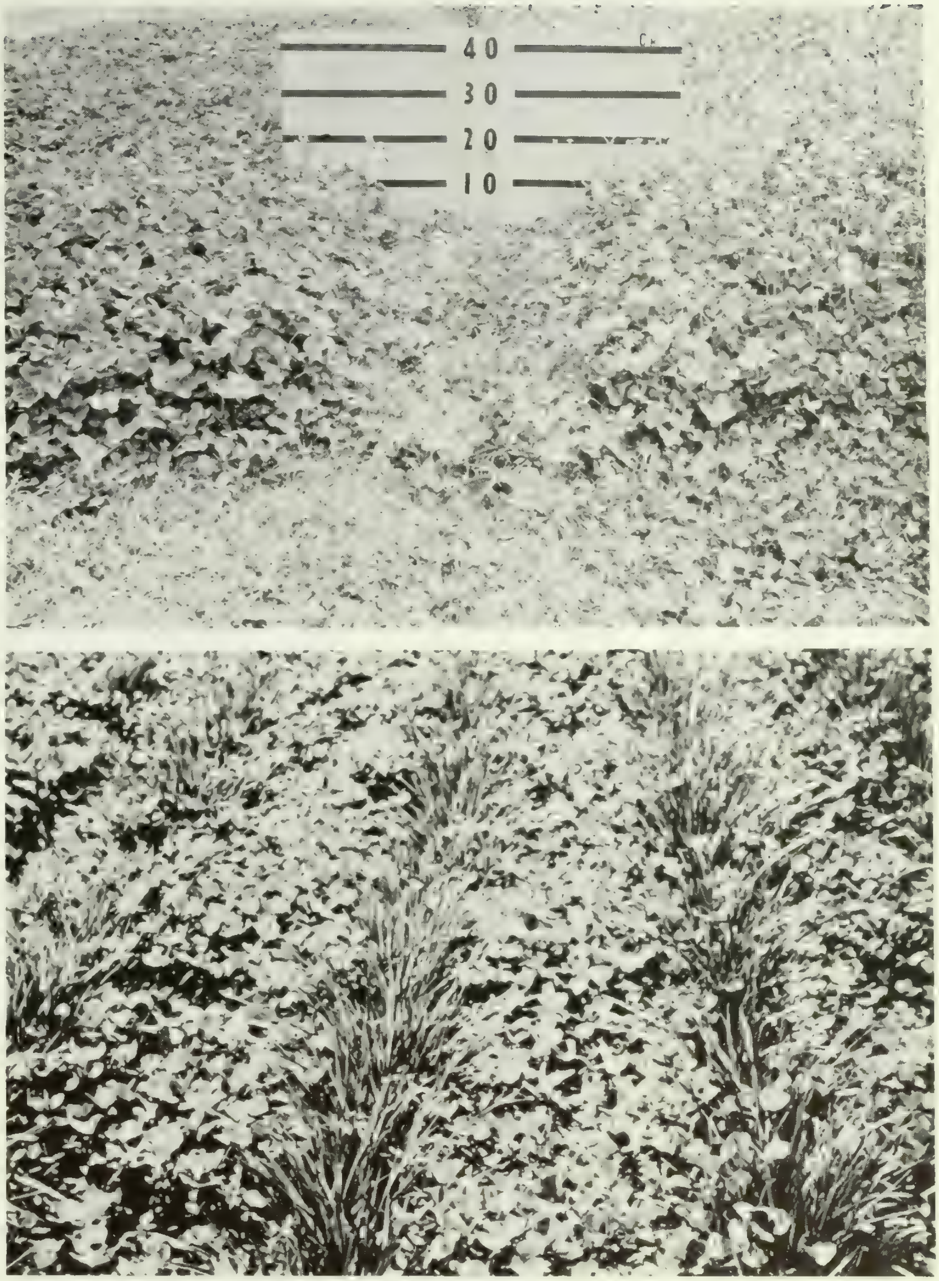

Figure 4. White clover is popular grown with either bermudagrass (top) or tall fescue (bottom).

Seed Production[2]

Seed set of white clover usually is heavy if there are numerous bees for cross pollination and if it is warm and dry during the flowering period. Ripe seed and heads in full bloom occur on the same plant because white clover blooms over a long period. The seed should be harvested when the greatest number of seed heads are light brown, usually 25 to 30 days after bloom.

Harvesting Hay

The fineness of growth and leafiness of white clover require minimum handling in haymaking to avoid excessive shattering of leaves.

Harvesting Seed

Seed of white clover are harvested from pastures or from

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[2] The only area in the Southeastern United States where significant amounts of white clover seed are harvested is in Louisiana.

fields grown for seed only. Seed production from pastures requires early-season grazing or harvesting to reduce grass competition. Seed yields from pastures average 100 lbs per acre.

Most seed are harvested by cutting the crop with a mower and allowing it to cure in the swath or in small windrows. A high-speed, drum-type mower is most efficient in cutting the crop for combining. The cut crop should be handled as little as is possible because each handling causes shattering losses.

Artificial drying or drying by spreading the seed thinly under cover may improve the quality of seed. Rough cleaning reduces the time required for drying.

Stand Maintenance

Stands of white clover may persist for three or more years, depending on rainfall distribution in late spring and summer. Many producers help insure continuous stands by seeding at 1 lb per acre with an electrically-operated seeder mounted on the front of a tractor. They do this each fall when applying the phosphate and potash needed to maintain levels at medium or above.

WHITE CLOVER DISEASES AND INSECTS

Diseases

The most serious diseases of white clover are the stolon and root rots that may deplete stands seriously. Species of *Fusarium, Rhizoctonia, Colletotrichum, Leptodiscus, Curvularia,* and *Sclerotium* fungi are involved. Most of these organisms are part of a disease complex related to environmental factors.

Several viruses also infect white clover. Some viruses are spread by insects, and the degree of infestation may depend on the number and kinds of insects present. Symptoms include mild to severe mottling of leaves, destroying tissue between veins of leaves, and stunting of plants.

Insects

Insects that damage white clover include the clover leaf weevil, the lesser clover leaf weevil, lygus bugs, the potato leaf hopper, the garden fleahopper, the clover root curculio and the green June beetle.

The white clover seed crop in the South is threatened primarily by the lesser clover leaf and clover head weevils, *Hypera nigrirostris* F. and *Hypera meles* F., respectively. Larvae of these insects attack parts of the flowering head, stunting or destroying heads and preventing seed formation.

Nematodes

Species of root-knot nematodes are among the most common of the many kinds of nematodes that parasitize white clover. Root-knot nematodes cause root swellings or galls that resemble the nodules produced by nodule-forming bacteria.

PRODUCTION POTENTIAL OF WHITE CLOVER

Producers and researchers have been emphasizing better quality forage with better seasonal distribution as one means of better using land resources to produce food. Grazing systems also have been developed to minimize the amounts of feed harvested, stored and fed back to cattle. Recent economic studies in support of this research have stressed that yield alone does not necessarily make a practice economical; rather, it is the amount and quality of forage (measured in energy units) consumed and converted into beef or milk that is important (2, 6, 7, 8).

Most white clover is grown in mixtures with grasses for grazing. Close grazing affects white clover less than it does most annual clovers because new vegetative growth arises from the stolons that grow parallel to the soil. The succulent, highly nutritious forage is exceedingly palatable at all stages of growth to all classes of livestock. Plants may contain 25 to 30% crude protein when grazed at immature stages, 18 to 22% crude protein when harvested at a hay stage of growth. Crude protein content often is in excess of 15% even at maturity. Mixtures of white clover and grasses also make hay that is high in protein, minerals and vitamins.

Results of research in 1968 and 1969 demonstrated that clovers grown with Coastal bermudagrass produced much higher forage yields than grass grown alone with 200 lbs of nitrogen applied per acre each year (Table 3), and forage produced by the clover-grass mixtures was of higher quality and better seasonal distribution. Also, Coastal bermudagrass following crimson and arrowleaf clovers produced about 1 ton more of dry forage per acre than a grass check that received 200 lbs of nitrogen per acre.

White clover grown with bermudagrass or dallisgrass produced higher dry matter yields than the grasses grown alone fertilized with 120 lbs of nitrogen per acre (Table 4). Yield of white clover-tall fescue was higher than that of the fescue grown alone with 180 lbs of nitrogen applied. White clover-bahiagrass produced more than bahiagrass alone fertilized with 240 lbs of nitrogen per acre. Forage production of the clover-grass mixes also was more evenly distributed, and estimates of forage quality were higher than for the grasses grown alone.

Table 3. Yields of dry forage from selected clover species overseeded[1] in a Coastal bermudagrass sod, with comparisons, 1968-69 average.

	Yield		
Clover species	**Clover**	**Grass**	**Total**
	--------Lbs DM/A--------		
Crimson	2660	9770	12,430
Arrowleaf	2170	9170	11,340
Red	5600	4440	10,040
White	6520	3680	10,200
Check - Grass alone NoCo[2]		2340	2,340
Check - Grass alone N_1 CO[3]		7740	7,740

[1] Overseeded in a Coastal bermudagrass sod in September, 1967. Yields of annual clovers were from volunteer stands in 1969. Stands of red and white clovers were from initial seeding.

[2] NoCo = No nitrogen, no clover

[3] N_1 CO = 200# N/A annually, no clover.

Dry matter production of five varieties of white clover evaluated in Mississippi in 1963-67 ranged from 2 to 5 tons per acre, depending on rainfall distribution and year (Table 5). Regal and Tillman produced the highest summer yields, and production was more evenly distributed than for the other varieties.

Dry matter yields of the 15 varieties and selections compared in production trials since 1975 have ranged from just over 6,000 to slightly less than 11,000 lbs per acre (Table 6). The advantage of the ladino types is shown clearly in the performance of Regal, Tillman, improved synthetics and experimental varieties. The advantage of superior persistence bred into Tillman and 'SC-NGP' was evident from second-year production when grown on a prepared seedbed (Table 7) and third-year production when grown with Coastal bermudagrass (Table 8).

Table 4. Yields of bermudagrass, dallisgrass, bahiagrass, and tall fescue grown alone and fertilized with varying rates of nitrogen, and grown with white clover without nitrogen fertilizer.

Nitrogen Lbs/Acre	Dry Matter Yield[1]			
	Bermudagrass	**Dallisgrass**	**Bahiagrass**	**Tall Fescue**
	----------------Lbs/A----------------			
0	2900	3274	3409	2425
60	4805	4062	3646	3299
120	5982	4386	5015	3858
180	6900	5166	5088	4497
240	7275	5907	5928	5818
white clover	6225	4680	7082	4597

[1] Dry matter yields represent a four-year average.

P_2O_5 and K_2O applied at a constant rate of 120 lbs per acre.

Table 5. Dry matter yield of five white clover varieties, 1963-1967 average.[1]

	Dry Matter Yield					
Variety	1963	1964	1965	1966	1967	5 yr Avg.
	Lbs/A					
Louisiana S-1	218	6212	5957	2952	3620	3791
Regal	3842	10364	9413	5992	3122	6546
Tillman	3463	9872	8549	4838	3416	6027
Espanso	4436	9368	7990	5030	3549	6074
Ladino	4151	8957	8514	5194	3012	5965
LSD (.05)	225	754	378	682	N.S.	

[1] P_2O_5 and K_2O applied in a single application of 120 lbs of each per acre annually.

Table 6. Dry matter yield of white clover grown on a prepared seedbed, by variety, 1975-1976.

	Harvest Period			
Variety	Winter[1]	Spring[2]	Summer[3]	Season Total
	Lbs DM/A			
Brown Loam (Miss. Expt)	1,321	5,239	2,488	9,048
California Ladino	1,215	5,289	2,397	8,901
Clarence	1,231	3,995	810	6,036
Florida XP-1	1,299	6,147	2,681	10,127
Idaho	1,322	4,760	1,463	7,545
KO 176 (Arcadia)	1,365	5,996	2,720	10,081
La S-1	1,269	4,900	1,778	7,947
Lucky	1,196	4,828	2,720	8,744
Merit	1,098	5,826	2,635	9,559
New Zealand	1,000	4,568	1,554	7,122
Nolin's Imp.	1,405	4,768	1,939	8,112
Regal	1,448	6,201	3,109	10,758
Sacramento	1,209	6,321	2,468	9,998
SC-NGP	1,297	5,727	2,999	10,023
Tillman	1,499	5,831	2,865	10,195
LSD (.05)	102	844	216	1002
C.V.%	19.5	15.3	20.9	7.8
Planted: Sept. 29, 1975				

[1] Winter Harvests: Feb. 27, 1976; March 18, 1976

[2] Spring Harvests: April 5, 1976; April 29, 1976; May 25, 1976; June 15, 1976.

[3] Summer Harvests: June 29, 1976; July 15, 1976; Aug. 3, 1976; Aug. 27, 1976; Sept. 10, 1976.

Table 7. First- and second-year dry matter yield of white clover seeded on a prepared seedbed in 1974.

1974-75 Yields (First Year)

	Season of Harvest and No. of Harvests				
Variety	Winter	Spring	Summer	Fall	Total
	1	3	3	1	8
	-----------------Lbs/A-----------------				
Regal	1291	4253	2579	478	8601
Tillman	1376	4487	2474	534	8871
SC Nematode Res.	1158	4101	2179	442	7877
Nolin's Imp.	1210	3313	946	93	5562
Brown Loam Exp.	450	3850	1462	313	6075
LSD (.05)					872
C.V.%					7.2

1975-76 Yields (Second Year)

	Season of Harvest and No. of Harvests				
Variety	Winter	Spring	Summer	Fall	Total
	1	3	2	2	8
	-----------------Lbs/A-----------------				
Regal	490	3267	867	1202	5827
Tillman	405	3501	1012	1311	6229
SC Nematode Res.	522	3451	938	1241	6152
Nolin's Imp.	321	3134	750	958	5164
Brown Loam Exp.	436	3084	785	1042	5346
LSD (.05)	N.S.	N.S.	N.S.	130	N.S.
C.V.%	17.9	12.7	14.1	6.9	10.9

Table 8. First-, second- and third-year dry matter yield of white clovers overseeded on Coastal bermudagrass in 1974.[1]

1974-75 Yields (First Year)

	No. of Harvests and Yield Component		
	7	5	—
Variety	**Clover**	**Grass**	**Total**
	Lbs DM/A		
Regal	5,360	1,768	7,128
Tillman	6,079	1,546	7,625
SC Nematode Res.	5,421	1,609	7,030
Nolin's Imp.	3,366	2,931	6,298
Brown Loam	2,683	2,196	4,879
Grass (CK)	—	6,827	6,827
LSD (.05)	397	341	807
C.V.%	5.6	8.0	8.1

1975-76 Yields (Second Year)

	No. of Harvests and Yield Component		
	7	5	—
Variety	**Clover**	**Grass**	**Total**
	Lbs DM/A		
Regal	9,318	1,472	10,790
Tillman	9,314	1,035	10,349
SC Nematode Res.	9,801	894	10,695
Nolin's Imp.	4,324	3,110	7,434
Brown Loam	7,217	2,207	9,424
Grass (CK)	—	6,745	6,745
LSD (.05)	1,003	470	1,098
C.V.%	8.9	12.9	8.4

1976-77 Yields (Third Year)

	No. of Harvests and Yield Component		
	7	5	—
Variety	**Clover**	**Grass**	**Total**
	Lbs DM/A		
Regal	3,766	4,494	8,260
Tillman	4,625	3,804	8,429
SC Nematode Res.	4,904	4,186	9,090
Nolin's Imp.	1,411	5,222	6,633
Brown Loam	2,804	4,880	7,683
Grass (CK)	—	7,233	7,233
LSD (.05)	1,342	1,245	1,227
C.V.%	25.4	16.6	10.3

[1] Clover-grass mixtures received 400 lbs/A 0-24-24 applied annually in the fall. Grass check plots received 200 lbs/A N applied as ammonium nitrate in split applications and 400 lbs/A 0-24-24 applied in the fall.

DESCRIPTION OF WHITE CLOVER VARIETIES

Common is the usual designation for white clovers without a variety name. These types are intermediate in size and usually are referred to in Mississippi as white 'Dutch' clover.

Louisiana S-1 is an intermediate type released in 1952 by the Louisiana Agricultural Experiment Station. It is widely used in the lower half of the Gulf States because it reseeds and persists. Short drought stress causes prolific flowering.

Ladino is a common reference to several strains of white clover with large leaflets. More than one half of the white clover acreage in the United States is seeded to the large types. The large types do not flower as profusely or bloom as early as the intermediate types.

'Espanso' is the largest white clover available and is a selection made in Italy for uniformity of type, maximum size and yield, and resistance to low temperatures and drought. It is not grown widely in Mississippi.

'Merit' was released in 1970 by the Iowa Agricultural Experiment Station and is a 30-clone synthetic selected for resistance to leafhopper damage and drought. It is winter-hardy and has performed well in Mississippi trials.

Regal was released in 1962 by Auburn University and is a five-clone synthetic selected for persistence and summer production. It is highly popular with livestock producers in Mississippi. Production data show that it produces two to four times the summer yield of Louisiana S-1.

Tillman is a large type released in 1965 by the USDA and the South Carolina Agricultural Experiment Station. It is a six-clone synthetic with improvements added to Regal for summer production, persistence, disease resistance, sparse flowering and profuse stolon branching. It performs very well in Mississippi.

Nolin's Improved is a naturalized variety that originated on the farm of W. T. Nolin, Hamburg, La. It is adapted to the conditions of Louisiana and the lower South, and behaves as a reseeding or volunteering winter annual.

'Sacramento' blooms about three weeks earlier than other varieties and maintains bloom through the season. It is merchandised by the Berger and Plate Co.

'Lucky' is a new synthetic variety developed in Oregon for absence of leaf-marking. It has not been a top performer in Mississippi under initial testing.

Arcadia is a synthetic variety developed by Northrup, King and Co. It was originally tested as KO-176, and performance in Mississippi is similar to that of Regal and Tillman.

'Clarence' is an Australian variety of the intermediate type. It is totally unadapted in Mississippi.

Brown Loam (Mississippi Experimental) was selected by N. C. Edwards at the MAFES Brown Loam Branch at Raymond, Miss. It currently is being evaluated in several trials. Twenty-seven clones isolated after a four-month drought in 1976 are under evaluation as the base for a synthetic variety (Figure 5).

Figure 5. Nursery of drought tolerant clones of white clover selected by N. C. Edwards of the Brown Loam Experiment Station.

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Pasture Weed Control in Mississippi

Between 4 and 5 million acres are used for growing forage and pasture crops in Mississippi. The grasses and clovers grown on these acres vary widely in type, yield, and quality but all have one thing in common---little value until marketed through livestock. Production and management practices used in the past 20 years have resulted in several-fold increases in forage and livestock production. However, it is estimated that only 20% of pasture acreage is maintained in improved grasses and legumes, only 10% is fertilized properly, and less than 5% receives some form of weed control. The following guidelines were developed to show the types of weed problems present in Mississippi pastures and the impact they can have on forage and pasture systems.

Types of Weed Damage

Most pastures have some weed pressure and the most obvious effect of weeds is a lower yield of desirable species, which in turn results in less efficient use of the land resource. Weeds also may harbor insects and disease organisms that attack desirable plants in the same or adjacent fields. Other less obvious effects of weeds are decreased forage quality, lower animal acceptability, slower curing time in hay production systems, and exposure of animals to toxic constitutents. Carlisle (1978) found published evidence that 8 of 10 summer weeds in Mississippi contain one or more toxic compounds. Some of the more important compounds and their effects on livestock are presented in Table 1.

Production losses from weeds are much higher than is generally recognized but are hard to assess because weeds are so common and widespread. Two practical approaches to weed control in forage and pasture systems are prevention and control. Klingman (1966) defines prevention as stopping a given species from contaminating an area. This is best accomplished by (1) making sure that new weed seeds are not brought to the farm in contaminated crop seeds and feed, or by machinery and (2) preventing weeds on the farm from going to seed. Control is the process of limiting weed infestations and the amount of control usually is balanced between the costs involved and the amount of possible injury to the pasture or crop.

Table 1. Toxic Compounds Found in Mississippi Weeds

Compounds	Effect on Livestock
Nitrate	death
Soluble oxalates	death
Glycoside dugaldin	dehydration
Tremetol	dehydration-death
Resinoids	death
Glycoalkaloid solanine	death
Lysergic acid alkaloids	hallucination
Triterpenoid acids	death

Weed Classification

Effective pasture weed control is obtained only when weed populations are properly classified. Knowing the length of life of the weeds, the time of year when they grow and their method of reproduction helps in determining the proper method to use for maximum control. Pasture weeds are classed as annuals, biennials, or perennials.

Annual plants complete their life cycle from seed to seed in less than one year. They are further classed as summer annuals or winter annuals depending on the time of year when maximum growth occurs. For example, summer annuals germinate in the spring, make most of their growth in the summer and usually mature and die in the fall. A biennial plant lives for more than one year but not over two years. Perennials live for more than two years and may live indefinitely. Reproduction is either by seed or from rootstocks. Perennials are often the most difficult group of pasture weeds to control.

Methods of Weed Control

Methods of weed control normally are listed in one of six groups---(1) mechanical, (2) chemical, (3) crop rotation, (4) crop competition, (5) biological, and (6) fire. The two most common methods used in Mississippi are mechanical and chemical. Mechanical control involves any type of implement, such as a mower, harrow, disk or cultivator. These tools either cut off, bury, or lift the weed from the soil. Mechanical weed control is effective on annual weed species.

Use of herbicides to control weeds in pastures has increased rapidly in the last 20 years. The herbicides most commonly used in pasture weed control are classified as contact or systemic, depending on their effects on plants. Contact herbicides kill the plant parts covered by the chemical. There is little or no translocation or movement of this type of herbicide through living cells. In general, plants or plant parts treated with contact herbicides die soon after treatment. Contact herbicides are mainly effective against annual weeds and only defoliate the tops of perennial weeds. Systemic herbicides, in contrast, are absorbed either by the roots or above ground parts of plants and subsequently are moved throughout the plant. They are effective against annual, biennial or perennial plants. The full effects of systemic herbicides will not become apparent for several days after treatment.

Both contact and systemic herbicides also may be selective or non-selective. A selective herbicide kills or retards some plants with little or no injury to others. A non-selective herbicide is toxic to all plants.

Time of Treatment

Chemicals usually are applied preplant, preemergence or postemergence. Preplant treatment is made before the crop is planted, preemergence is any treatment made before emergence of a specific crop or weed, and postemergence treatment is made after emergence of a specified crop or weed.

Types of Formulations

Herbicides rarely can be used as active ingredients alone, and inert ingredients are added to make handling and application safe, easy and accurate. The most common types of herbicide formulations available for pasture weed control are emulsifiable concentrates (EC or E), solutions (S), granules (G), and wettable powders (WP).

An emulsifiable concentrate can be mixed with water to form an emulsion. Each gallon of an EC usually contains 2 to 8 pounds of active ingredient. Diluted EC's usually need some agitation to maintain the emulsion in the spray tank.

Solutions or high concentrates usually contain 8 or more pounds of active ingredient per gallon. They may contain only the active ingredient.

Granular formulations are dry. Most are made by applying a liquid formulation of the active ingredient to coarse particles of some porous material such as clay, corn cobs, or walnut shells. The amount of active ingredient in a granular material usually ranges from 2 to 40%. Granules are used most often as soil treatments and are safer from a spray drift standpoint than EC's or solutions.

Wettable powders are dry, finely-ground formulations. They mix with water and usually contain 15 to 95% active ingredient. Wettable powders form a suspension rather than a true solution when added to water, and good agitation in the spray tank is needed to maintain the suspension.

Application Equipment

Types of pasture sprayers used in Mississippi vary widely---ranging in type from those built in home shops to elaborate commercial models. Choice of equipment is extremely important to the success of a weed control program. The sprayer should be designed to do the job and should be durable and convenient to fill, operate and clean. Most pasture sprayers are low pressure units designed to deliver 10 to 40 gallons of water per acre at 15 to 50 pounds pressure. The advantages of this type sprayer are the use of medium to large tanks, low cost, light weight and versatility. Limitations are low gallonage output, low pressure limits and moderate agitation. Specific plans for various type sprayers are available from the Cooperative Extension Service in your county.

Pasture Categories

Three categories of pastures generally can be identified in pasture weed control programs. They are (1) established perennial grass pastures with broadleaf and/or grassy weeds, (2) established grass-clover pastures with broadleaf and/or grassy weeds, and (3) newly planted grass, clover, or grass-clover pastures. Primary weed species found in each category are presented in Tables 2, 3 and 4.

The broadleaf weeds in category (1) can be easily controlled with herbicides now cleared for pastures. However, as use of clovers and other legumes becomes more widespread, the broadleaf weed problems in categories (2) and (3) probably will increase.

With the exception of smutgrass, producers often treat the grassy weeds in categories (1) and (2) as grazable herbage and feel that a concerted effort to control specific species with chemicals usually is not economical. The target species presented in Table 4 probably cause the greatest losses of new seedings.

Table 2. Primary broadleaf weed species in established grass and grass-legume pastures in Mississippi

Common Name	Scientific Name
Redroot pigweed	*Amaranthus retroflexus*
Lambsquarter	*Chenopodium album*
Common yarrow	*Achillea millefolium*
Common ragweed	*Ambrosia artemisiifolia*
Mayweed	*Anthemis cotula*
Horseweed	*Erigeron canadensis*
Bitter sneezeweed	*Helenium amarum*
Goldenrod	*Solidago sp.*
Woolly croton	*Croton capitatus*
Virginia copperleaf	*Acalypha virginica*
Curly dock	*Rumex crispus*
Buttercup	*Ranunculus sp.*
Blue vervain	*Verbena hastata*
Prickly sida	*Sida spinosa*
Horsenettle	*Solanum carolinense*
Smartweed	*Polygonum pensylvanicum*
Thistle	*Sonchus sp.*
Dogfennel	*Eupatorium capillifolium*
Onion-garlic complex	*Allium sp.*
Wild lettuce	*Lactuca scariola*
Dandelion	*Taraxacum officinale*
Annual fleabane	*Erigeron annuus*
Narrowleaf vetch	*Vicia angustifolia*

Table 3. Primary grassy weed species in established grass and grass-legume pastures in Mississippi

Common Name	Scientific Name
Broomsedge	*Andropogon virginicus*
Smutgrass	*Sporobolus poiretii*
Foxtail	*Setaria sp.*
Little barley	*Hordeum pusillum*
Goosegrass	*Eleusine indica*
Barnyardgrass	*Echinochloa crusgalli*
Broadleaf signalgrass	*Brachiaria platyphylla*

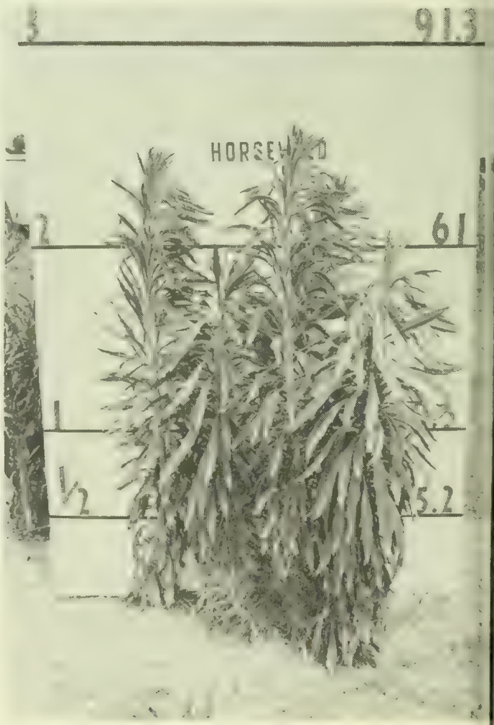
Chemical Programs Used in Mississippi

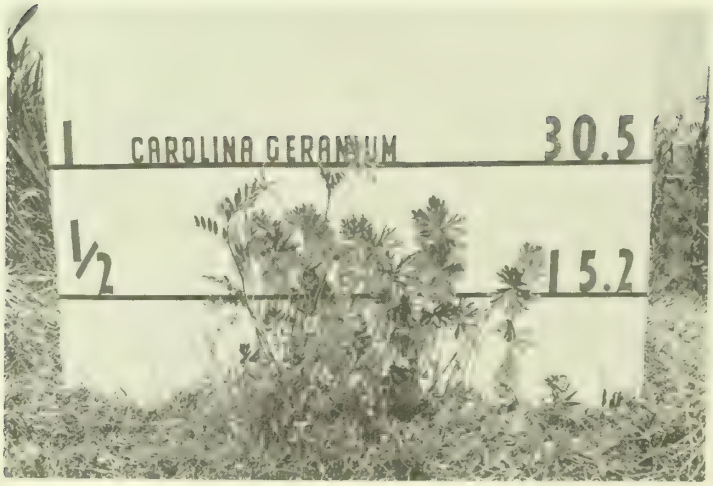
Herbicide research results are reviewed annually, and specific recommendations are published in the joint MAFES-MCES publication entitled **Weed Control Guidelines for Mississippi.** Recommendations for 1978 are presented in Table 5. **Caution: always read the label on the particular material you plan to use before making any herbicide application.**

Examples of Important Broadleaf Pasture Weeds in Mississippi

horseweed[1]

Annual. Short taproot, stems one to six feet tall, bushy branched in upper portion, rough-hairy. Numerous narrow, hairy leaves, alternate. Small flower heads with yellow centers. Found in peach orchards, old fields, fencerows.





Carolina geranium

Winter annual or biennial. Smooth, erect, reddish stems, widely branching at base. Deeply cut leaves alternate or opposite. Compact flower clusters at tips of stems and branches. Small, pink flowers. Long, pointed seed pods. Found in lawns, gardens, pastures, cultivated fields.

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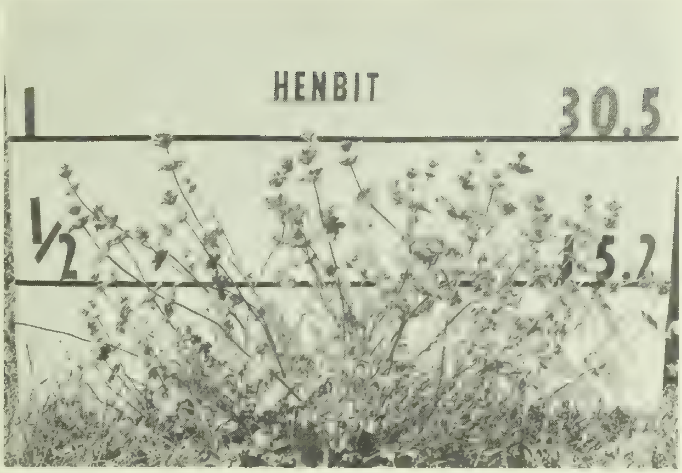
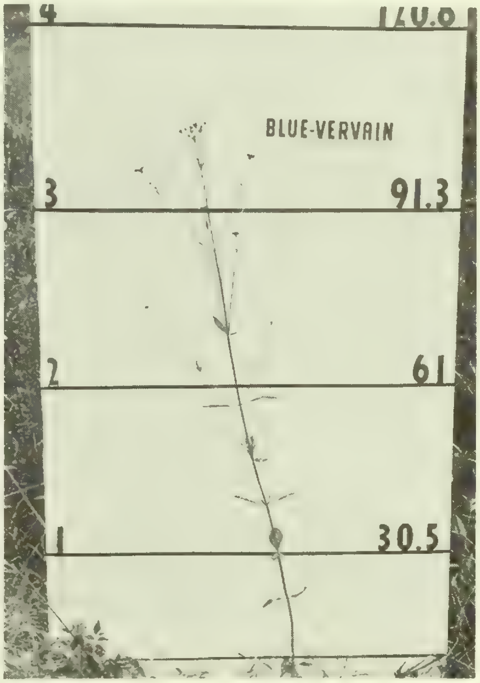
[1] *Weed descriptions taken directly from the publication entitled* **Weeds of the Southern United State** *published by the Mississippi Cooperative Extension Service based on information prepared from a grant to t Georgia Cooperative Extension Service from the Federal Extension Service.*



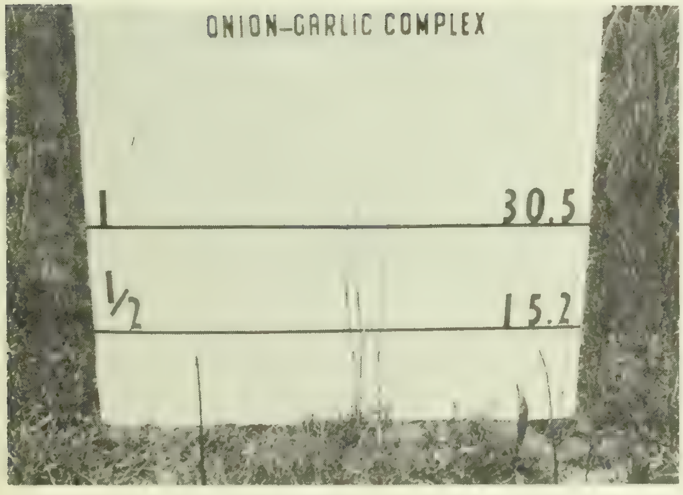
henbit

Winter annual. Stems square, four to six inches tall, nearly smooth. Slightly hairy leaves, rounded in outline, edges deeply scalloped, opposite. Purple or reddish-purple flowers borne at base of upper leaves. Found in grain fields, lawns, gardens, pastures, wastelands.



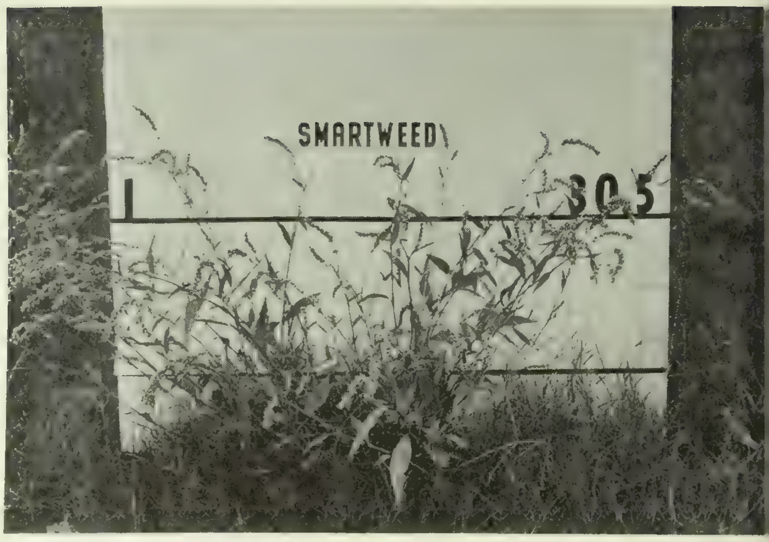
blue vervain

Summer annual. Stems four angled, rough, slender, branched. Leaves narrow, long, sparse, serrate. Flower spikes crowded, purple, small. Found in waste places, fencerows, pastures, roadsides.



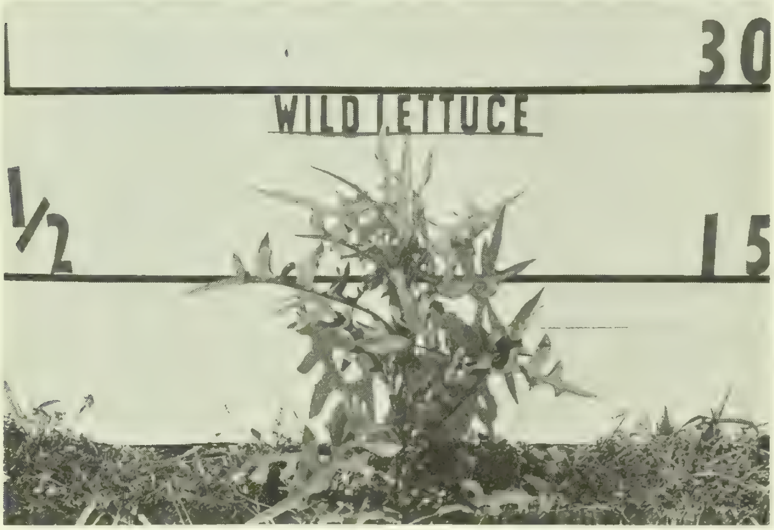
onion-garlic complex

Perennial. Stem with two to three hollow, round leaves from base of plant. Plant develops from basal bulb, covered with a thin, whitish, papery coat. At maturity, the bulb is covered with small, yellowish bulbs which readily split apart. Flowers are greenish-pink to purplish, often among small, greenish, aerial bulblets. Found in lawns, fencerows, pastures, small grain.



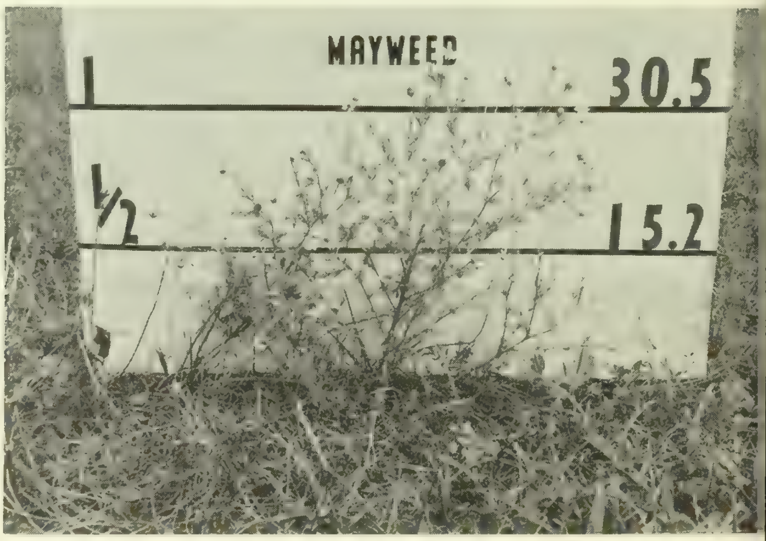
Pennsylvania smartweed

Summer annual. Stems smooth, swollen at nodes, branching, one to four feet tall. Leaves smooth, pointed, alternate, with sheath at base surrounding stem. Flowers pink or rose, on short spike. Seed smooth, shiny black. Found in cultivated fields, ditches, wastelands.



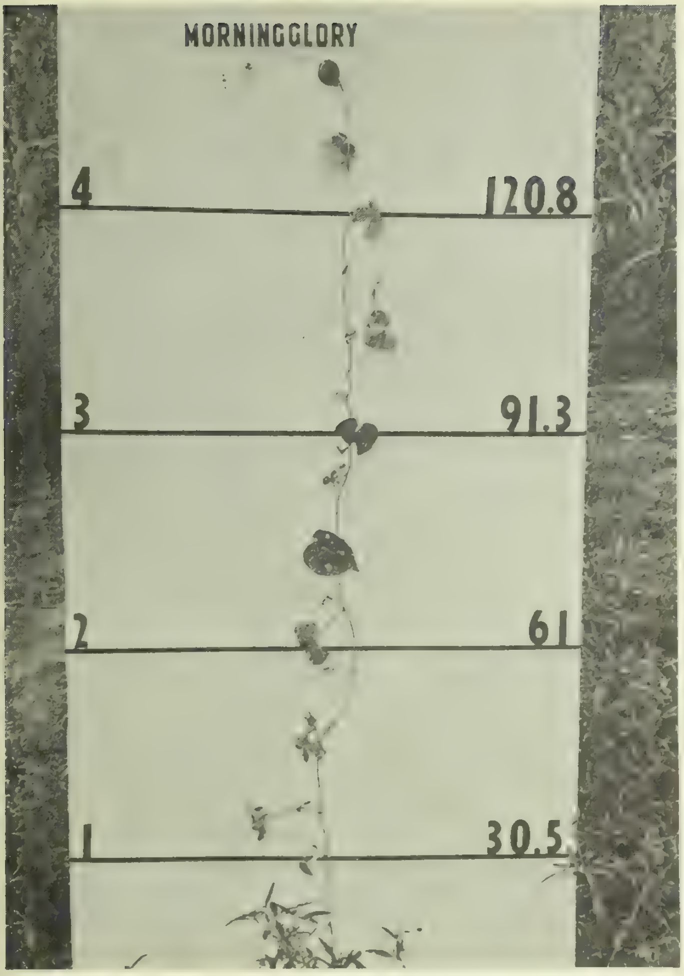
wild lettuce

Winter annual. Long, fleshy taproot, erect stems two to five feet tall, branched in upper portion. Milky juice. Leaves often turning to vertical position. Leaves alternate, edges deeply cut to form lobes with spiny or toothed edges. Mid-vein prickly beneath. Flower heads small with yellow petals. Found in cultivated fields, wasteland and roadsides.



mayweed

Winter annual. Erect stems much branched, ½ to two feet tall, nearly smooth. Leaves finely cut, hairy, alternate, strong, unpleasant odor when crushed. Flower heads like a small daisy, center yellow, encircled by white petals. Found in unimproved pastures, old fields, waste places.

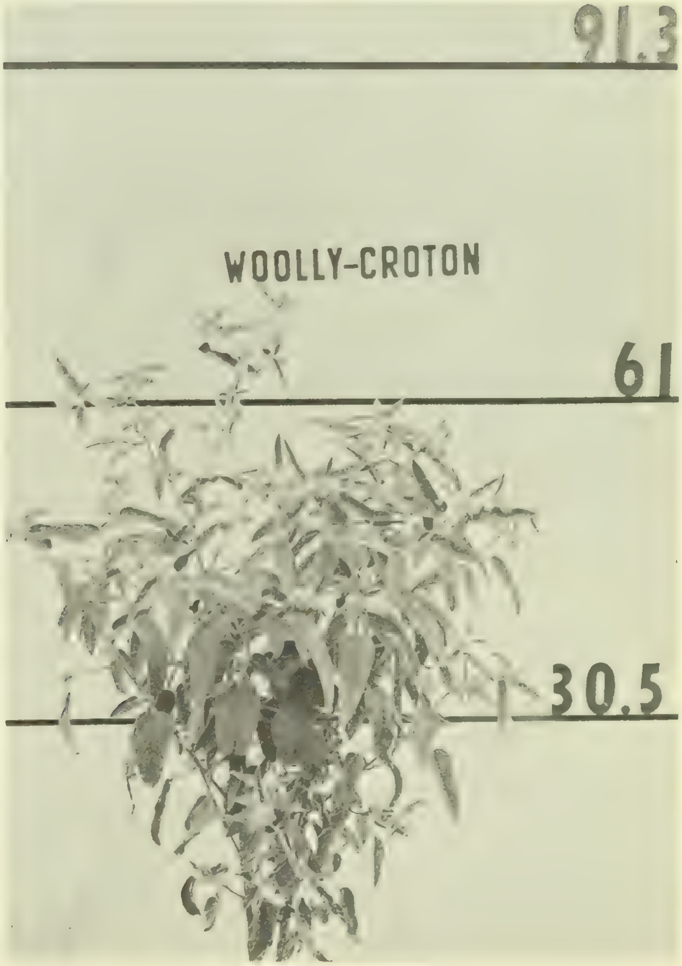


morningglory

Annual. Trailing or twining, hairy stems. Alternate leaves broad, heart-shaped. Funnel-like flowers in clusters of three to five. Flowers red, purple, blue or white. Seed brown to black. Found in cultivated and abandoned fields.

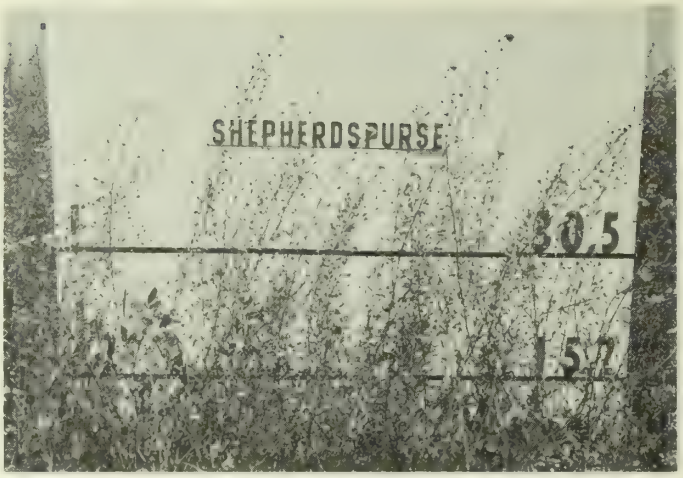
woolly croton

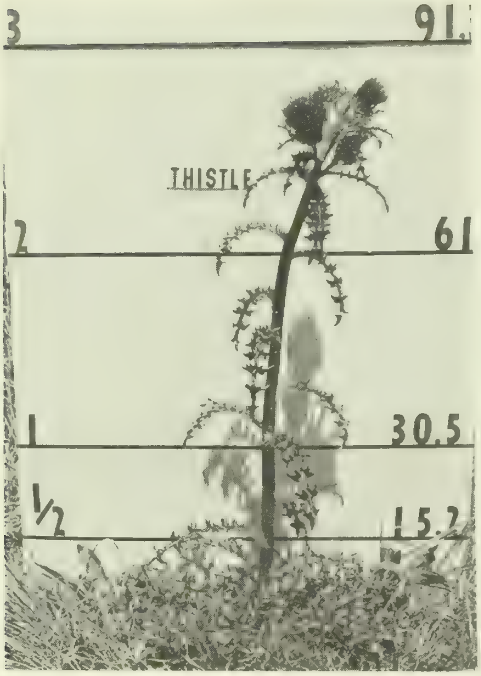
Summer annual. Stems one to three feet tall, branched. Leaves alternate, narrow, on long stalks. Stems and leaves densely hairy, grayish-green in color. Flowers in tight clusters at ends of branches. Seed pod densely hairy, three-lobed, with three seed. Found in cultivated and abandoned fields.



shepherdspurse

Winter annual. Smooth, branched stem with few leaves, from basal rosette of leaves. Stems erect, ½ to 1½ feet tall. Flowers small, four-petaled, in elongated racemes at branch ends. Seed pods angularly heart-shaped, with two parts. Seed many, yellowish. Found in cultivated and abandoned fields.



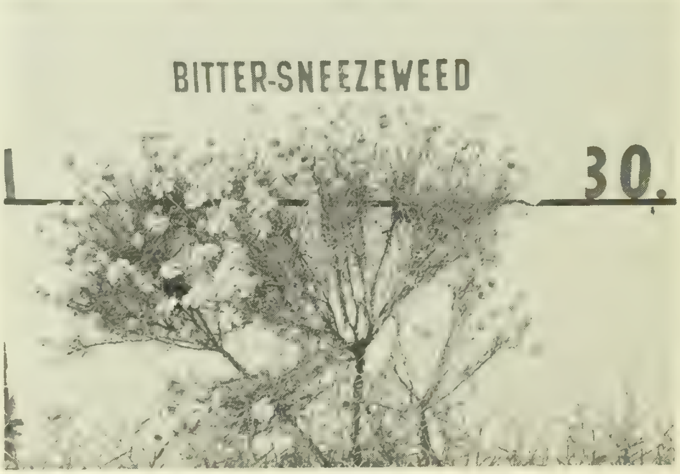


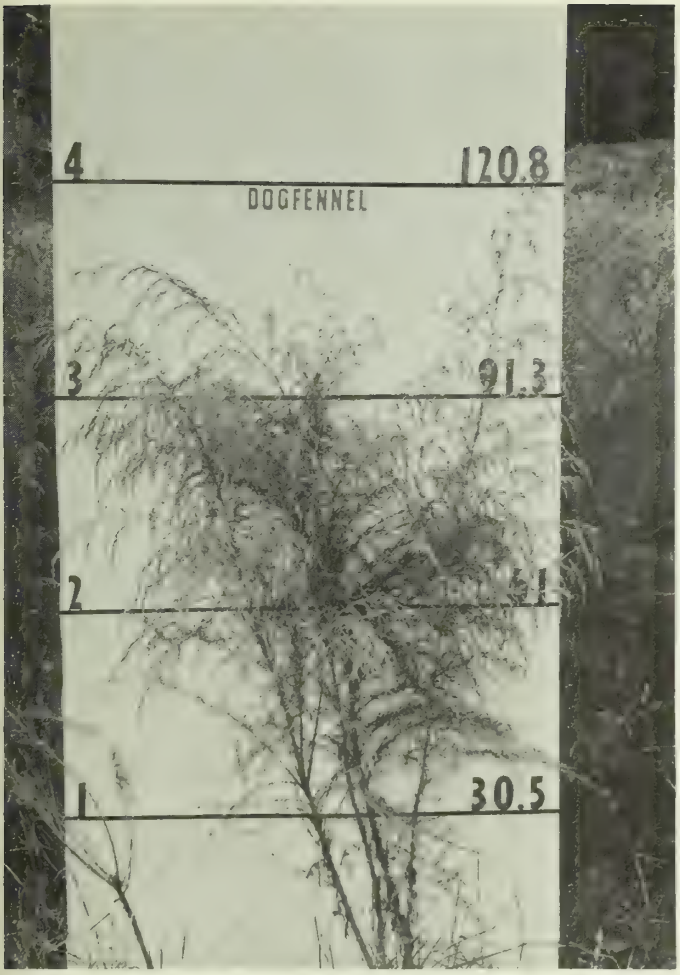
thistle

Winter annual. Stem smooth, green or purple, branched. Leaves mostly entire, prickly-edged, clasping stem with pointed to rounded lobes. Flower heads small, yellow, on numerous branches. Found in gardens, pastures, roadsides, abandoned fields.

bitter sneezeweed

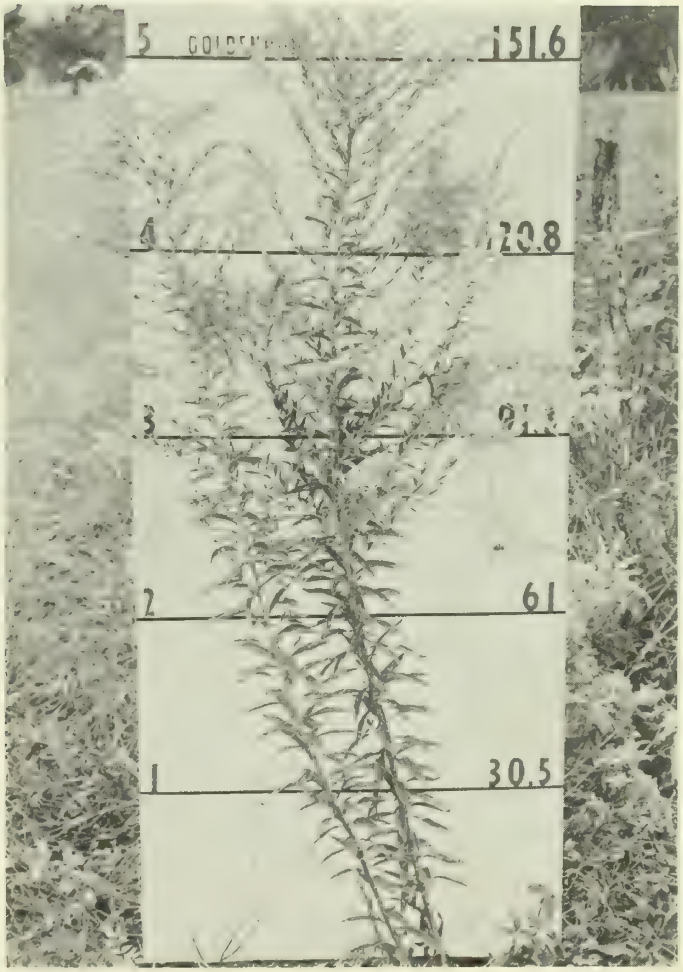
Summer annual. Stems 4 to 24 inches tall, purplish color, branching. Leaves small, thread-like, numerous. Flower heads yellow, center dome-like. Plants with pungent odor. Bitter taste, imparting undesirable odors or flavors to dairy products. Found in wastelands, unimproved pastures.





dogfennel

Perennial. Shallow taproot, multiple reddish-purple stems three to nine feet tall, branching near top. Leaves divided into several thread-like segments. Numerous tiny, white flowers developing extremely small seed tipped with feathery crowns. Found in unimproved pastures and old fields.

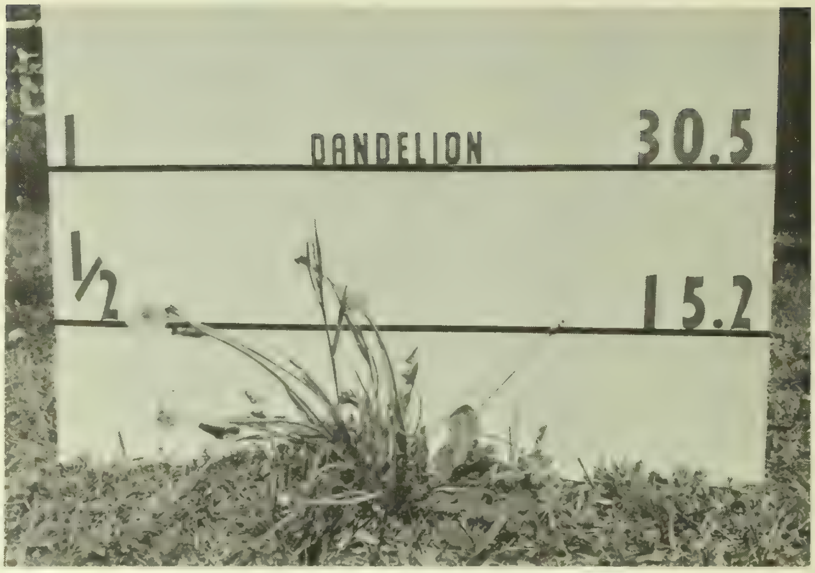


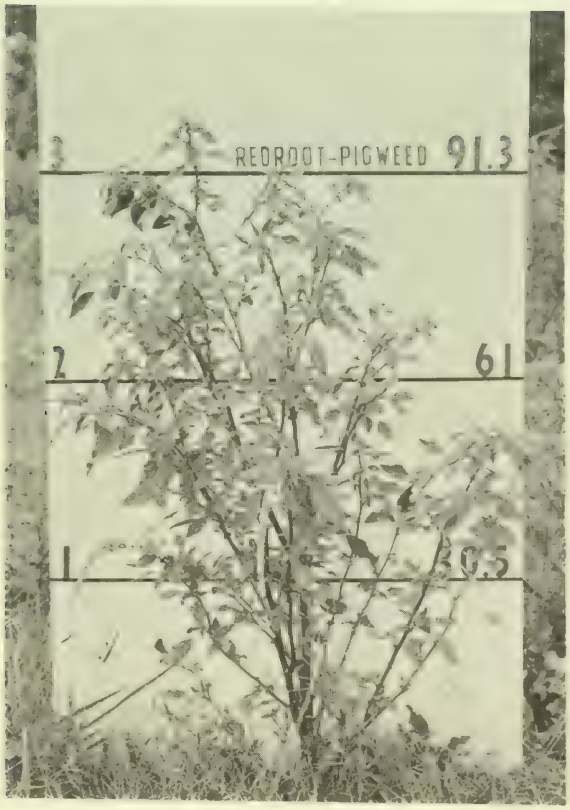
goldenrod

Perennial. Stems ½ foot to four feet tall, hairy, grayish-green. Basal leaves tongue-shaped, upper leaves smaller. Flower heads small, clustered on slender, curving branches two to eight inches long. Found in old fields, fencerows and open woods.

dandelion

Perennial. Root thick, fleshy. No stem. Leaves in rosette from crown, simple, variously lobed, milky juice. Yellow flowers, heads borne on long, bare, hollow stalk. Seed elongate, tipped with tuft of hairs. Found in lawns, pastures, gardens, waste areas.

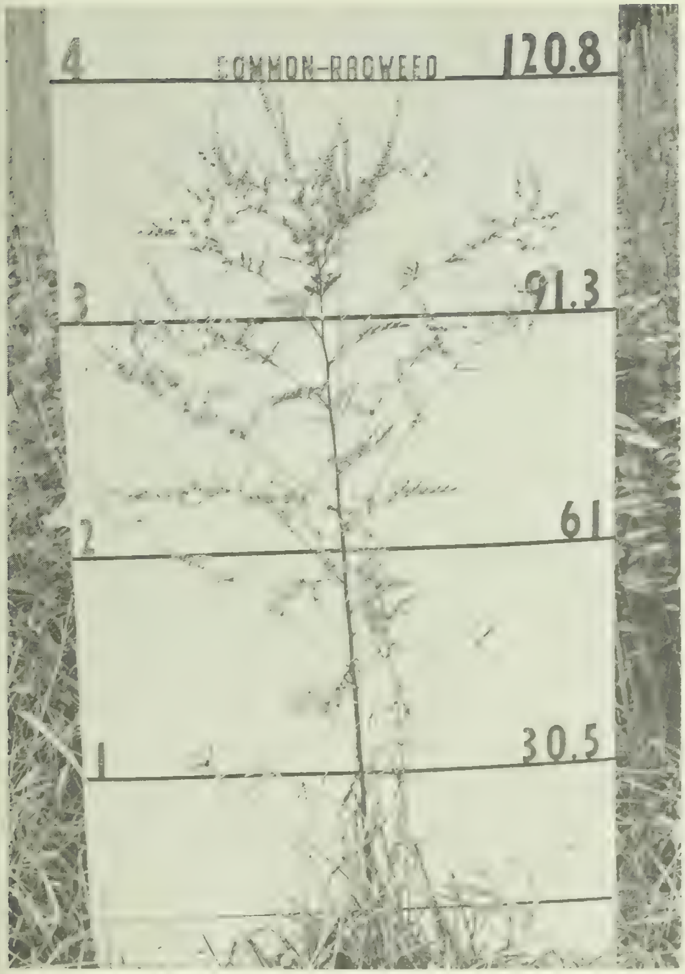




redroot pigweed

Summer annual. Stems erect, to six feet tall, rough textured, freely branching. Dull green leaves, long petioles. Small, green flowers in dense spikes in upper leaf axils and stem ends, with three spiny bracts around each flower. Shiny black, tiny seed. Found in cultivated fields, barnyards, fencerows and waste areas.

Smooth pigweed (*A. hybridus*) is similar but petioles shorter, plant texture not rough, with fewer, less dense flower spikes.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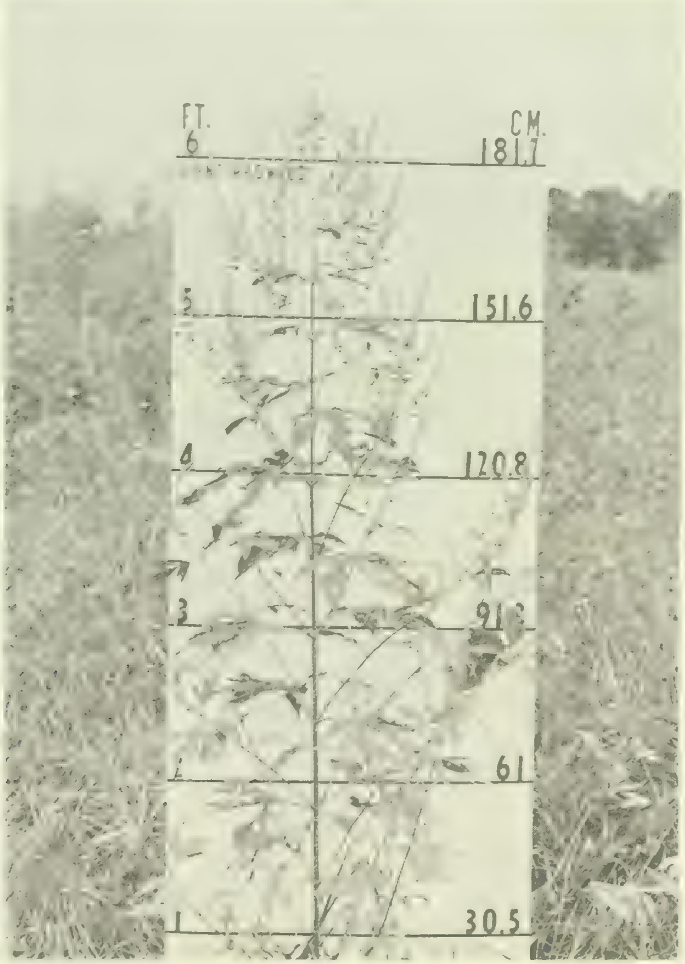
common ragweed

Summer annual. Erect, rough, hairy, purple, branching stems one to six feet tall. Smooth leaves deeply cut into several toothed portions, alternate. Flower heads of two kinds: 1—pollen-producing, small, inverted cups in slender clusters at tips of branches. 2—seed heads borne at leaf bases and forks of upper branches. A common weed found in all croplands.

giant ragweed

Summer annual. Stems 6 to 12 feet tall. Leaves large, three- to five-lobed, in pairs at the stem joints. Similar to other ragweeds in flower, fruit and habitat.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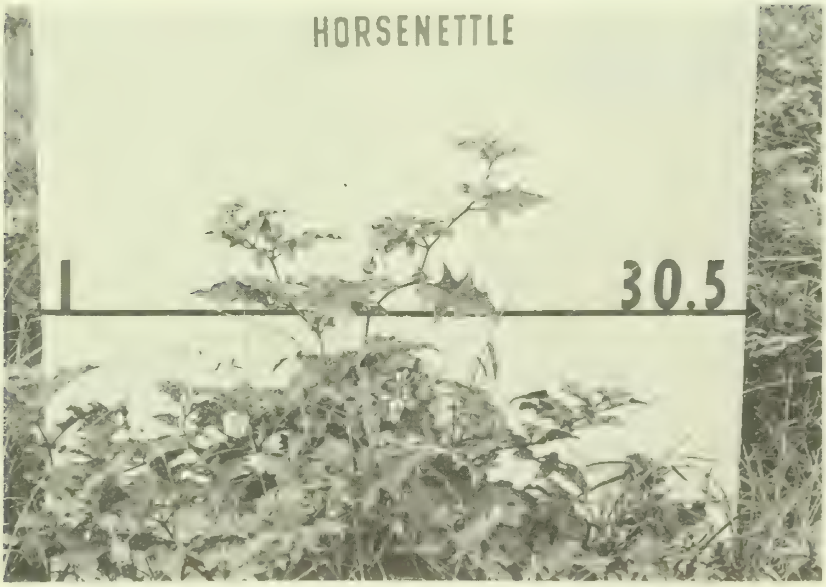
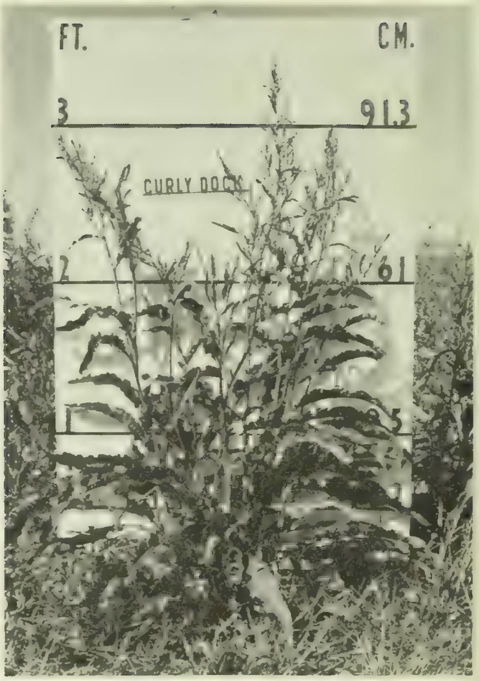
horsenettle

Perennial. Extensive, deep, creeping rootstocks. Stems single or branched, one to two feet tall. Leaves alternate, wavy edges or lobed, with yellow spines on leaf mid-ribs, veins and stems. Purplish or white flowers in clusters from stem ends. Smooth, large, yellowish-orange berries. Found in cultivated fields and wastelands, pastures, roadsides.



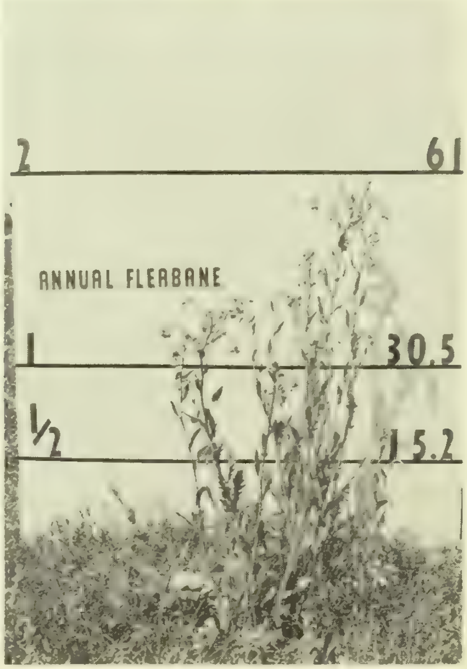


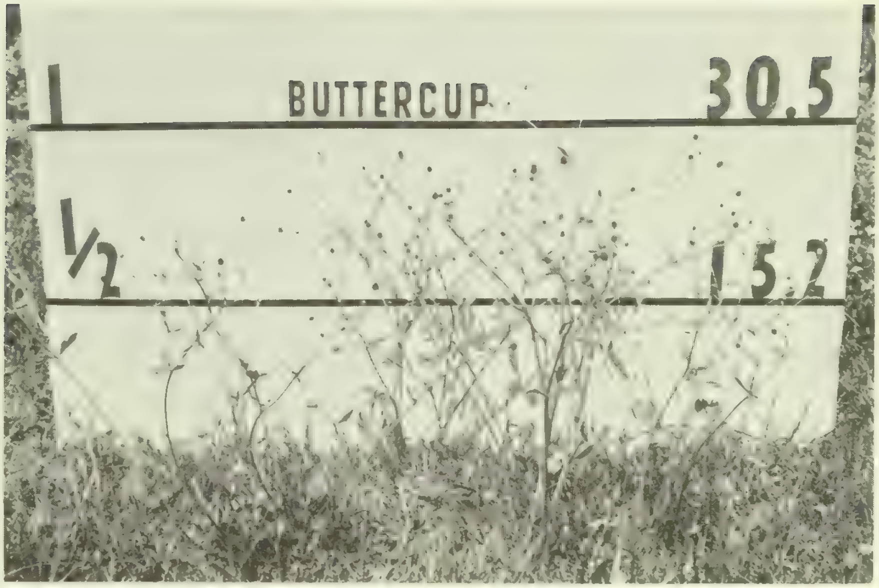
curly dock

Perennial. Large, yellow taproot. Stems smooth, erect, one to four feet tall, one or more from root crown. Leaves mostly basal, lance-shaped, with wavy-curly edges. Flowers in dense clusters at stem tip, green, becoming reddish-brown. Seed shiny black, triangular. Found in pastures, roadsides, wastelands.

annual fleabane

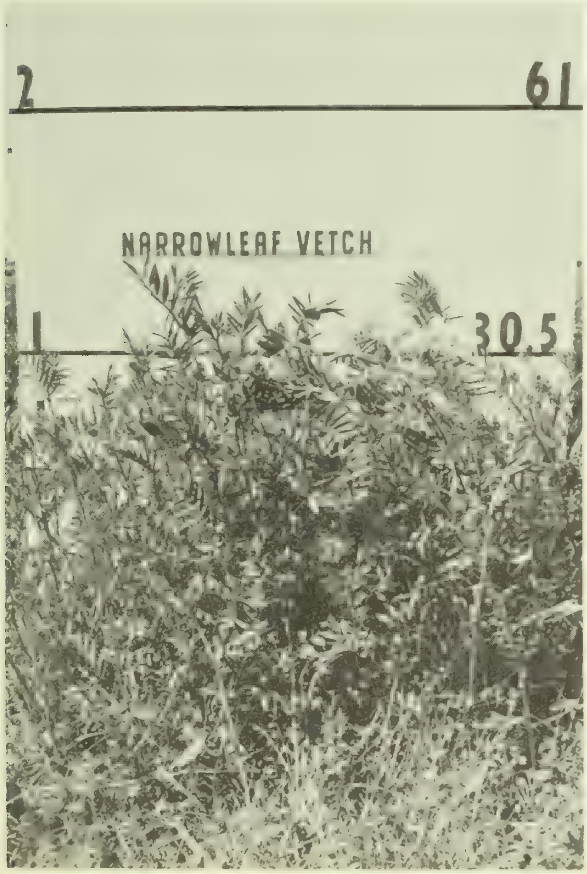
Summer annual or biennial. Stems one to two feet tall, branching near top. Leaves mostly at stem base, upper leaves smaller. Flower head single at branch ends, disc flowers yellow, encircled with white to light purple petals. Found in old fields and waste places.





buttercup

Winter annual. Stems slender, branched from base. Lower leaves round, bright green, on long petioles. Upper leaves on short petioles, divided into leaflets. Flowers small, yellow. Seed on round heads, flattened, with curved or hooked beak. Poisonous, acrid. Found in lowland pastures.



narrowleaf vetch

Winter annual. Vines or stems smooth, weak, with tendrils at leaf tips. Leaves compound with 8 to 12 leaflets. Flowers purple, with 4 to 12 flowers per raceme. Pods smooth, seed olive to brownish-black. Found in fields and wastelands.

Value of a Sound Pasture Weed Control Program

Our approach to pasture weed control research has been based on evidence that (1) all pasture acreage has some degree of weed pressure and (2) it takes as much or more fertilizer to grow a pound of weeds as a like amount of desirable forage. Three common pasture weeds---pigweed, smartweed and ragweed---have been shown to accumulate 2.0 times as much nitrogen, 1.6 times as much phosphorus and 3.5 times as much potassium as does a desirable forage plant such as corn.

Trials to determine the value of weed control in a typical pasture situation were initiated in 1975 on weed-infested bahiagrass in Jefferson and Pearl River Counties. Heavy pressures of 2,4-D tolerant weeds existed---mainly dogfennel, smartweed, horsenettle and prickly sida. The Jefferson County experimental area had a heavier weed infestation and a thinner sod of bahiagrass than did the experimental area in Pearl River County.

Plots in each test were treated with per acre rates of 0.25 lb dicamba or 0.25 lb dicamba plus 0.75 lb 2,4-D. An untreated plot served as a check in each test area. No fertilizer was applied to the treated plots or the checks. Herbicides were applied broadcast in May and bahiagrass production was measured 75 days later.

The increase in bahiagrass production attributed to herbicide effectiveness (Table 6) ranged from 470% in Jefferson County (0.25 lb dicamba + 0.75 lb 2,4-D) to 698% in Pearl River County (0.25 lb dicamba). Value of the increased production at $20 per ton of dry matter (the approximate cost of producing bahiagrass in 1976, not including harvesting cost) ranged from $23.49 to $44.08 per acre (Table 7). An example of the typical control obtained in this experiment is shown in Figure 2.

Weed control reduced the lignin content of the bahiagrass to as

Table 4. Primary broadleaf and grassy weed species in new seedings of grass, legume, or grass-legume pastures in Mississippi

Common Name	Scientific Name
Carolina geranium	*Geranium carolinianum*
Sheperdspurse	*Capsella bursa-pastoris*
Virginia pepperweed	*Lepidium virginicum*
Morningglory	*Ipomoea sp.*
Chickweed	*Stellaria media*
Henbit	*Lamium amplexicaule*
Crabgrass	*Digitaria sanguinalis*
Crowfootgrass	*Dactyloctenium aegyptium*
Texas panicum	*Panicum texanum*

Figure 1. It takes 80 lbs of high quality forage to produce a 1-pound beefsteak. Without effective weed control methods, the quality will be lower, it could take three times as much.

Table 5. Chemical Weed Control Recommendations for Mississippi.

Pasture Weed Category	Situation	Active Chemical/A	Formulation Needed for 1 acre treated broadcast	Time of Application	Weeds Controlled	Special Instructions and Remarks
Established perennial grass pasture with broadleaf weed problem.	Pre-emergence	2,4-D at 1.0 to 2.0 lb/A	Broadcast: 2,4-D amine-1 to 2 qt in 10 to 20 gal water.	Before bitterweeds emerge; in late Feb. or March.	Bitterweed	Safe time to spray pastures next to cotton land or other susceptible crops.
	Post-emergence	2,4-D at 0.7 to 1.0 lb/A	2,4-D amine-0.66 to 1.0 qt in 10 to 20 gal water.	April to July.	Most broadleaf weeds.	Do not make treatments during long droughts. Do not apply to annual legumes until after seed production.
		dicamba at .25 to 1.0 lb/A.	Broadcast: .25 to 1.0 qt of Banvel in 20 to 40 gal water.	When weeds are actively growing.	Most broadleaf weeds and small brush.	Do not harvest seed for feed or food and do not graze meat animals in treated field within 30 days before slaughter. Do not graze dairy animals on treated areas within 7 days if 1/2 lb. is used or within 21 days if 1 lb. actual/A is applied. Dairy animals should not be fed dry hay from treated areas within 51 days after treatment.
		2,4-D at 0.75 lb/A + dicamba at 0.25 lb/A.	2,4-D at 0.75 qt and Banvel at 0.25 qt in 10 to 20 gal water per acre.	When weeds are actively growing.	Most broadleaf weeds and some hard to control ones, such as dogfennel, horsenettle and cypressweed.	Same precautions as for dicamba alone.
Established perennial grass pasture with a smutgrass problem.		dalapon 3.40 to 4.25 lb/A.	Dowpon M-4 to 5 lbs in 20 gal. water.	When smutgrass is actively growing (8-10 in. tall).	Smutgrass and most annual grasses.	Apply to tall actively growing smutgrass. Do not mow within 3 to 4 weeks before application. Best control with least reduction in grazing occurs when application is made well in advance of first frost; generally between Sept. 15 and Oct. 15. Mow 2 weeks following application and if desired overseed winter grazing crops. Do not graze lactating dairy animals or slaughter beef animals within 6 weeks after application.
Established bermudagrass pasture with annual weed problem		paraquat at 0.25 lb/A.	1.0 pt of Paraquat CL in 20 to 30 gal water.	Mid-March	Emerged annual broadleaf and grassy weeds.	Add 1.0 qt of non-ionic surfactant per 100 gals of spray solution. Do not graze or mow for hay until 40 days after treatment.
Established grass-clover pastures with broadleaf weed problem.		2,4-DB at 0.5 to 1.0 lb/A.	Broadcast: 2,4-DB, 1.75 lb material, at 1-2 qts/A in 10 to 20 gal water.	When broadleaf weeds are actively growing.	Most broadleaf weeds.	Apply before weeds are 3 inches in height. Do not graze or cut hay within 30 days after treatment.
New plantings of hybrid bermudagrass.		simazine 2 to 3.2 lb/A	Broadcast: Simazine 80W-2.5 to 4 lb/A.	After bermuda is sprigged and before weeds emerge	Most annuals and some seedling perennials.	Use higher rates on heavier soils-light rate on sandy soils.
		2,4-D at 2 lb/A.	Broadcast: 2,4-D amine-2 qts in 10 to 40 gal water.	After bermuda is sprigged and before weeds emerge.	Most annuals and some seedling perennials.	Follow precautions on label.

Table 6. Influence of Chemical Weed Control on Bahiagrass Production.

Location	Rate	Chemical	Broadleaf weeds after 75 days	Bahiagrass Dry Matter Yield Total	Bahiagrass Dry Matter Yield % of Check
	Lbs (a.i.)/A		%	Lbs/A	
Jefferson Co.		None	92.0	635	---
	0.25	dicamba	0.0	3005	473
	0.25 + 0.75	dicamba + 2,4-D	0.0	2984	470
Pearl River Co.		None	79.4	748	---
	0.25	dicamba	0.0	5156	698
	0.25 + 0.75	dicamba + 2,4-D	2.0	4703	628

Table 7. Value of Weed Control in Bahiagrass

Location	Rate	Chemical	Bahiagrass Dry Matter Yield	Per Acre Values as Hay Total	Per Acre Values as Hay Increase Attributable to Spraying
	Lbs (a.i.)/A		Lbs/A	$	$
Jefferson Co.		None	635	6.35	---
	0.25	dicamba	3005	30.05	$23.70
	0.25 + 0.75	dicamba + 2,4-D	2984	29.84	$23.49
Pearl River Co.		none	748	7.48	---
	0.25	dicamba	5156	51.56	$44.08
	0.25 + 0.75	dicamba + 2,4-D	4703	47.03	$39.55

[1] **Based on a value of $20.00 per ton for unharvested forage.**

little as 5.9% (Table 8). Digestible dry matter increased from a low of 43.1% without weed control to as high as 58% with weed control. This increase in quality could be the difference in several pounds of digestible dry matter per ton of hay or grazing.

The percentage of crude protein in the bahiagrass was essentially the same for the check and treated plots (Table 9). However, if the increased production of desirable forage resulting from weed removal is considered, the increase in value of protein attributable to herbicide effectiveness ranged from $38 to $97 per acre (based on protein valued at 20¢ per pound, the approximate cost of a pound of protein from cottonseed meal).

In another experiment, a bermudagrass-dallisgrass pasture was treated with herbicides to remove infestations of smutgrass. Estimated forage quality was improved by controlling smutgrass (Table 10). Soluble cell content (SCC)---the highly digestible portion of the plant---and calculated

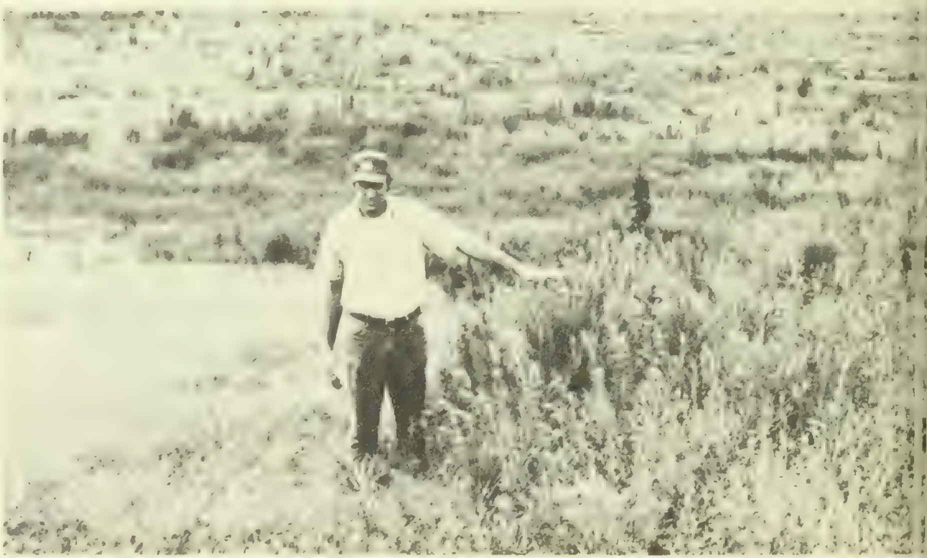


Figure 2. Example of weed control obtained from a singl application of dicamba left, check plot on right.

Table 8. Effect of Weed Control on the Forage Quality of Bahiagrass

Location	Rate Rate	Chemical	Lignin Content	Digestible Dry Matter
	Lbs (a.i.)/A		-------------%-	------------
Jefferson Co.		None	13.2	43.1
	0.25	dicamba	6.8	50.8
	0.25 + 0.75	dicamba + 2,4-D	6.1	49.7
Pearl River Co.		none	9.2	48.5
	0.25	dicamba	5.9	58.0
	0.25 + 0.75	dicamba + 2,4-D	5.9	57.2

Table 9. Effect of Weed Control on the Crude Protein Content of Bahiagrass forage

Location	Rate	Chemical	Crude Protein[1]			Increase Attributed to Spraying
	Lbs (a.i.)/A		%	lbs/A	$	
Jefferson Co.		None	7.4	46.8	9.36	---
	0.25	dicamba	8.1	242.2	48.40	$39.04
	0.25 + 0.75	dicamba + 2,4-D	7.9	235.1	47.02	$37.66
Pearl River Co.		None	10.7	79.6	15.92	---
	0.25	dicamba	10.9	564.0	112.80	$96.88
	0.25 + 0.75	dicamba + 2,4-D	10.4	491.0	98.18	$82.26

[1] **Yield calculated as D.M. yield x % crude protein**

[2] **Protein value assumed to be 20¢/lb., the approximate cost of a pound of protein from cottonseed meal.**

nutritive value both were increased significantly with 83% or more smutgrass control. The increase in value of forage attributable to quality improvement alone was greater than the cost of attaining the 83% or more smutgrass control.

We infer from the results of these experiments that increases in the quantity and quality of forage resulting from sound weed control programs will add more to the value of forage than the programs will cost in most instances. We plan additional trials for testing the validity of this inference.

Table 10. Forage quality estimates of a bermudagrass-dallisgrass pasture as affected by control of smutgrass.

Herbicide	Rate	Smutgrass Control	Soluble Cell Contents	Nutritive Value
	Lbs. (a.i.)/A	----------%-	---------	grams
None		0 c[1]	25.0 d	30.4 c[2]
Atrazine	4	88 a	28.3 c	33.9 bc
	8	97 a	32.4 ab	40.2 a
Bromacil	4	83 ab	29.4 bc	37.2 ab
	8	97 a	33.6 a	40.8 a

[1] **Means within a column that are followed by the same letter are not significantly different at the .05 level of probability.**

[2] **Grams digestible dry matter per kg of body weight to the 0.75 power.**

Herbicide Safety and Handling[2]

Herbicides always should be handled to minimize the possibility of harm to nontarget organisms (including man), either through contamination of food and water or by contact. All spraymen should be given training in the proper handling of herbicides. Suggestions are:

1. Know the material being applied; READ THE CONTAINER LABEL AND UNDERSTAND THE DIRECTIONS for preparing and applying the herbicide, and then FOLLOW THE DIRECTIONS.
2. Wear protective clothing and avoid prolonged exposure to herbicides. Special care should be exercised to prevent inhalation and contamination of the skin when handling concentrates (use respirators, impermeable aprons and gloves).
3. Avoid contamination of foods or drinking water of man and animals.
4. When herbicide contamination of the body occurs, wash the affected area quickly and thoroughly with soap and water. Wash with soap routinely after each day of spraying.
5. Keep spray equipment clean and in good condition. Flush equipment only where contamination will not affect man or wildlife.
6. STORE HERBICIDES IN PROPERLY LABELED CONTAINERS OUT OF REACH OF CHILDREN AND ANIMALS.
7. Dispose of empty containers safely (See Container Disposal Section.)
8. KNOW THE EMERGENCY MEASURES FOR TREATING ACCIDENTAL POISONING. When illness arises due to a possible overexposure to a herbicide, contact your local physician. Physicians and other medical authorities may obtain information on the toxicity of herbicides from the Poison Control Center, School of Pharmacy, University of Mississippi, University, Mississippi, Telephone number 234-1522.
9. If herbicides get into the eyes, flush the eyes with plenty of water for 5 minutes: Call a physician.
10. If a herbicide is swallowed, apply the first-aid treatment printed on the label of the container: Call a physician.

Mixing and Handling Herbicides[2]

1. Mix and prepare herbicides in the open or in a well-ventilated place. When handled in close quarters, highly toxic herbicides may cause poisoning through inhalation. If the herbicides are volatile liquids, they may cause fires or explosions.
2. Open herbicide containers carefully to prevent billowing of dusts or splashing of liquids.
3. Pour herbicides carefully to avoid spilling.
4. Use special containers---drums or pails---for mixing herbicides; never use food or beverage containers.
5. Never use your mouth to siphon a herbicide from a container.
6. Do not mix herbicides in concentrations higher than those recommended. Measure accurately. These practices will help insure the application of correct and safe dosages.
7. Avoid spilling concentrates on the skin or clothes, and keep them away from the eyes, mouth, and nose. If any spills, wash it off with soap and water and change contaminated clothing immediately. Launder contaminated clothing before wearing it again. Launder contaminated clothing separately. Do not launder with family wash.
8. Always wear rubber gloves when handling concentrates. Rinse the gloves with water before removing them; do not turn gloves inside out when removing.
9. To safely mix and prepare some herbicides, it is necessary to wear a respiratory device and protective clothing. The container label will tell if these precautions are needed.
10. Do not smoke, eat, or drink when mixing herbicides.

Applying Herbicides[2]

1. If the container label prescribes it, wear a respiratory device and protective clothing when applying a herbicide.
2. Do not apply dosages greater than those recommended on

---

[2] *The following guidelines were developed by the members of the Mississippi Weed Science Committee and presented in the Weed Control Guidelines for Mississippi.*

the container label.

3. Time your applications to prevent illegal herbicide residues from remaining on food, feed, or forage crops; allow the prescribed number of days' interval between the last herbicide application and harvest or grazing.
4. Guard against drift of herbicides onto nearby crops, pastures, or grazing livestock, or onto streams, ponds, lakes or other fishbearing waters. Do not dust or spray on a windy day.
5. Guard against runoff of herbicides into sources of water supply. Do not apply herbicides near dug wells, cisterns, or any other water sources into which they may run or be washed by rain. Do not clean application equipment, dump unwanted herbicides, or dispose of empty containers near these places.
6. When applying spray or dust, work into the breeze or at a right-angle to it; thus the herbicide will be blown away from instead of onto you. If this is not practicable, wear a respirator.
7. Do not smoke, eat or drink while actually applying herbicides.
8. Be careful not to rub eyes or mouth with your hands during applications.
9. If you should feel ill while applying herbicides, stop work at once and get medical attention.
10. At the end of a day's work, bathe and change all clothing. Launder the clothing before wearing it again. Launder contaminated clothing separately. Do not launder with family wash.
11. If your shoes are leather and have become heavily contaminated with herbicide that can be absorbed through the skin, do not wear them again; burn or bury them. It is impossible to efficiently decontaminate leather shoes. Rubber shoes may be washed with soap and water.

Protect Wildlife and Domestic Animals[2]

Unnecessary injury to fish, irds, honey bees and mammals iay result from:

1. Drift of herbicides to wooded areas occupied by wildlife; drift to land areas not intended for treatments; and drift to fish-bearing waters.
2. Runoff or washoff by rain from treated areas to fish-bearing water.
3. Applications made too often or in excessive dosages.
4. Applications of herbicides that have toxicities unnecessarily high for the required control.
5. Applications made at the wrong times.
6. Carelessness.

Some Suggested Precautions[2]

. Use the least toxic and least persistent herbicide that is effective for your purpose.

2. Guard against drift of herbicides to wooded areas inhabited by wildlife.
3. Prevent runoff of herbicides into fish-bearing waters.
4. Do not treat extensive areas of water in one operation; the decaying vegetation that would result might deplete the oxygen content of the water to the point of causing fish kills.

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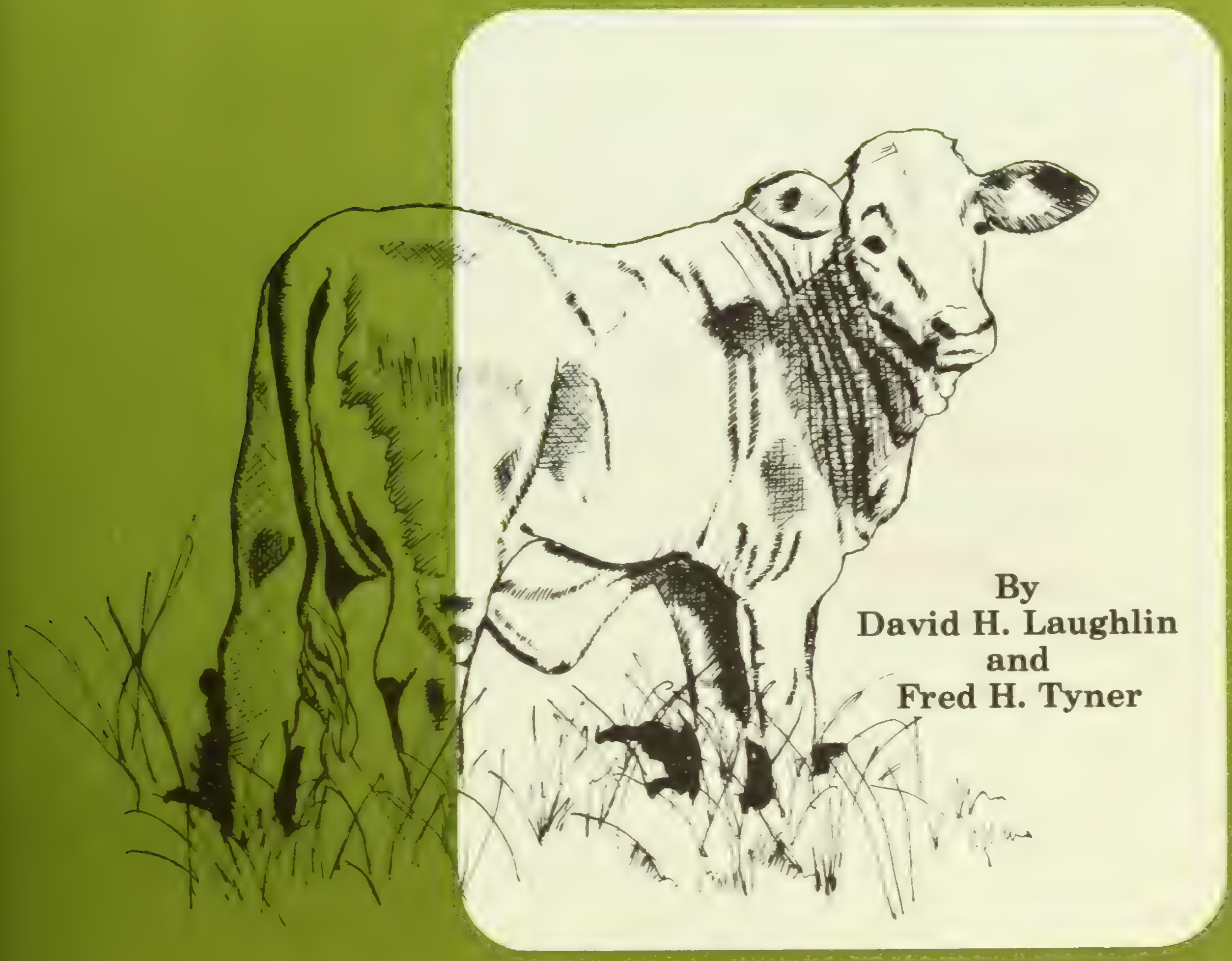

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Profitability of Systems For Growing and Finishing Weaned Calves in the Upper Coastal Plain of Mississippi

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September 1978

Profitability of Systems For Growing and Finishing Weaned Calves in the Upper Coastal Plain of Mississippi

SUMMARY

Cow-calf operations traditionally have been the major cattle enterprise in the state but recent low selling prices and high production costs for weaned calves have caused producers to search for more profitable enterprises. Available alternatives include carrying calves through the growing and/or finishing phases.

We evaluated the relative profitability of alternative growing and finishing systems for weaned calves in the Upper Coastal Plain area of Mississippi. Alternative systems were specified from combinations of (1) four initial weights, (2) two buying seasons, (3) three rates of gain, and (4) several selling weights. Maximum dry matter capacities of growing beef animals and monthly digestible protein and digestible energy requirements were specified. Monthly production of digestible protein, digestible energy, and dry matter was estimated for specified grazed forages.

The above considerations were incorporated into linear programming models to produce optimal solutions with operating capital unlimited or limited to $50,000 or $100,000; with and without silage; and with either 1.0 or 2.0 pound rates of daily gain on forages.

The optimal system (highest net returns to land, management, and general farm overhead) was obtained when 300-pound calves were started on winter grazing, allowed silage, and carried to finished weight at the 2.0 pound rate of gain. Pasture activities included ryegrass-wheat, sorghum x sudan, fescue-clover, and coastal bermuda-clover combinations. The system selected as "best" consisted of 400 calves purchased at 300 pounds in the fall and carried to finished weight at 2.0 pounds per day gain. All 360 acres of available land were used and $89,556 of operating capital was required. Net returns to land, management, and general farm overhead were $49,064.

Results indicate that appropriately selected programs for growing and finishing calves are profitable cattle alternatives for the study area.

INTRODUCTION

Cow-calf operations traditionally have been the major beef enterprise in Mississippi. However, the low selling prices and high production costs for weaned calves in the mid-1970's have caused producers to look for more profitable alternatives.

Mississippi has an ample supply of weaned calves and the soil and climate to produce high yields of high-quality forage for carrying calves through the growing and/or finishing phase, but little information exists to aid in identifying the most profitable systems. Therefore, we designed a study for estimating the profitability of alternative systems for growing and finishing calves on forages in the Upper Coastal Plain of Mississippi (Figure 1).

The study area is characterized by a topography that varies from level (generally in the bottomlands) to steep in the hill portions [8][1]. Many of the rolling

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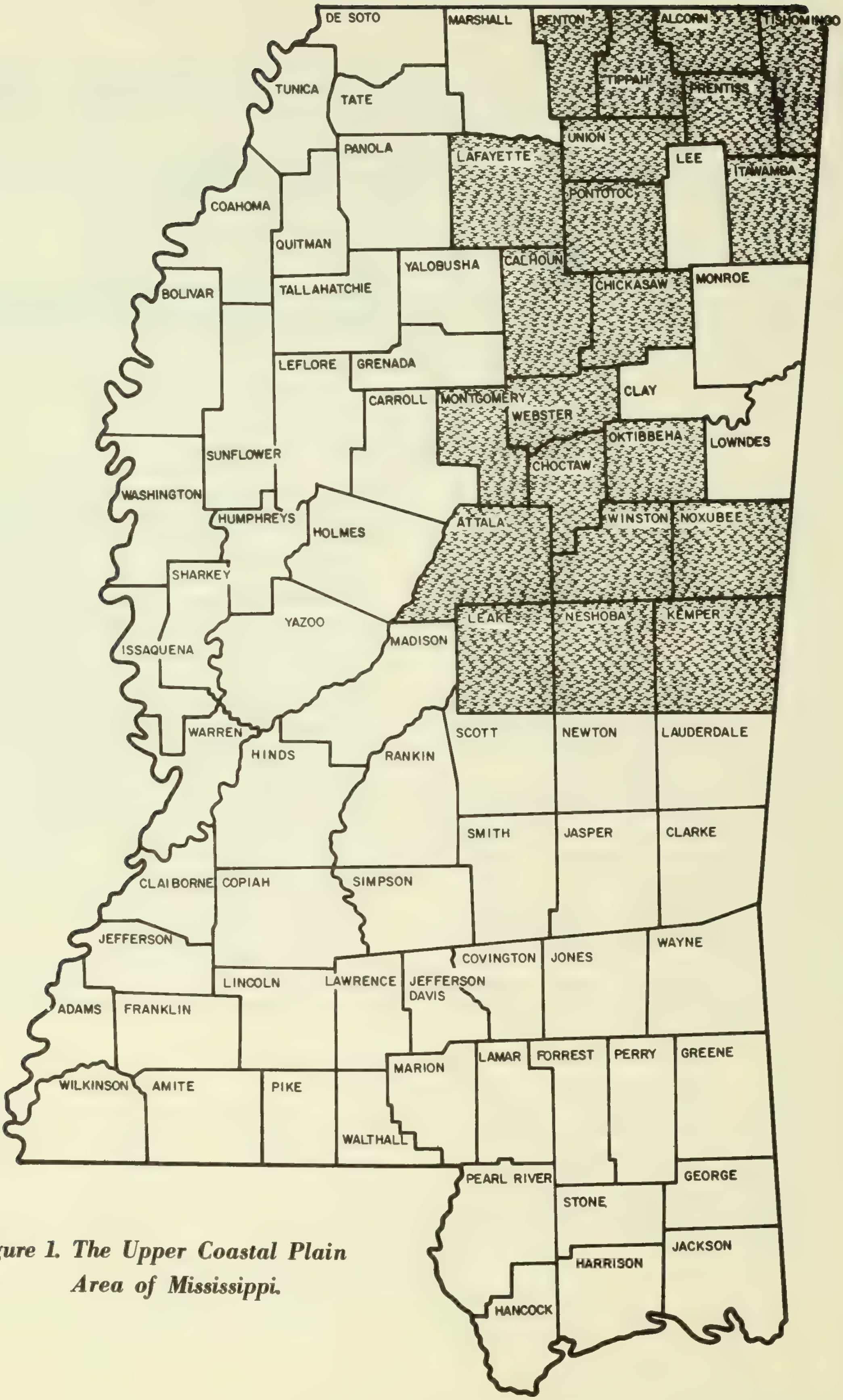
[1] *Numbers in brackets refer to references with corresponding numbers in the Selected References listed at the end of this publication.*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TISHOMINGO
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PONTOTOC
COAHOMA
QUITMAN
CALHOUN
YALOBUSHA
MONROE
CHICKASAW
BOLIVAR
TALLAHATCHIE
LEFLORE
GRENADA
CLAY
CARROLL
MONTGOMERY
WEBSTER
OKTIBBEHA
LOWNDES
SUNFLOWER
CHOCTAW
WASHINGTON
HUMPHREYS
HOLMES
ATTALA
WINSTON
NOXUBEE
SHARKEY
YAZOO
LEAKE
NESHOBA
KEMPER
MADISON
ISSAQUENA
WARREN
HINDS
SCOTT
NEWTON
LAUDERDALE
RANKIN
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JASPER
CLARKE
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
WAYNE
COVINGTON
JONES
LINCOLN
LAWRENCE
JEFFERSON DAVIS
ADAMS
FRANKLIN
LAMAR
FORREST
PERRY
GREENE
MARION
WILKINSON
AMITE
PIKE
WALTHALL
PEARL RIVER
GEORGE
STONE
JACKSON
HARRISON
HANCOCK

Figure 1. The Upper Coastal Plain Area of Mississippi.

hills of the area are not suited for cultivation but can be productive as pasture. The most frequently-occurring farm size is in the 260-499 acre group, with "livestock" and "general" farms predominating [6].

PROCEDURE

We specified a basic farm situation for the study area---a representative farm with 360 acres suitable for improved pasture, hay, or silage production. Animal, agronomic, and economic data were incorporated into a linear programming (LP) model for determining profit-maximizing combinations of enterprises for alternative systems for growing and finishing claves on forage.

Cattle Alternatives

The fall season traditionally has been the period when most Mississippi calves are marketed, with October being the heaviest marketing month [1]. Therefore, we assumed that 300-, 400-, 500- and 600-pound stocker animals could be bought in the fall for stocking winter pastures (November through April) and that animals weighing 500 or 600 pounds would be available for purchase in the spring for stocking summer pastures (May through October).

Alternative production systems were specified for calves of each weight bought in fall and in spring (Appendix I). Variables included in the alternatives for calves of each weight bought in fall and in spring included 180 days of winter grazing or 180 days of summer grazing, 180 days of winter grazing followed by 180 days of summer grazing[2] or 180 days of summer grazing followed by 180 days of winter grazing[2]. Average daily gain (ADG) on both winter and summer pasture was specified at 1.0 or 2.0 pounds. Also, some alternatives for calves bought at 400 and 600 pounds specified a 60-day feeding period at 2.5 pounds ADG.

Nutrition Requirements

Nutrient categories specified were digestible energy (DE), digestible protein (DP), and dry matter (DM). DP and DE are minimum requirements that must be met for animals of specified weights and rates of gain. DM is a maximum constraint to limit consumption of animals to their stomach capacity.

Estimates of nutritional requirements were developed from recommendations by H. W. Essig, Animal Scientist, MAFES Department of Animal Science; from data published by the National Academy of Science-National Research Council (NAS-NRC); and from a FORTRAN Program [3] developed by J. G. Dillard, formerly with the MAFES Department of Agricultural Economics.[3]

Monthly minimum DE and DP requirements and maximum DM capacities were calculated by weight group for 1.0, 2.0 and 2.5 pounds ADG. Average daily gains are predicated on the assumption that animals get the nutrients needed to gain at the rates specified. The linear programming model used insures that nutrient requirements are met in the optimal solutions.

Forage and Feeding Alternatives

The forage and feeding alternatives evolved primarily from studies by Dillard [3] and Smith [7], from discussions with V. H. Watson, agronomist, MAFES Department of Agronomy, and from our evaluation of current practices and possibilities in the study area.

DE and DP values of forages and feeds were calculated from monthly dry matter production estimates obtained from MAFES agronomists.

Forage Activities---Grazed forages, silages, and hays were considered as nutrient sources. Complete cost budgets (including labor and equipment) were obtained for each of the 19 forages considered (Table 1).[4] Corn and cottonseed meal were considered as supplementary sources of DE and DP and a finishing ration was included for systems requiring the finishing period.

Forage Yields and Use Estimates---Yields of forage crops are determined largely by weather variability and differences in cultural and fertilization practices. Differences in yield attributable to weather variability are difficult to assess; therefore, average dry matter yield was used as the measure of forage productivity. Average dry matter yields and recommended practices for attaining them were determined in consultation with V. H. Watson, agronomist, MAFES Department of Agronomy. Average yields of forage combinations (e.g., ryegrass-wheat and common bermuda-early ryegrass) were not available. Therefore, dry matter yields of forage combinations

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[2] Some alternatives included more than one cycle of winter-summer or summer-winter grazing.

[3] Dillard's program reflects recommendations of both Essig and NAS-NRC.

[4] Cost budgets are available in MAFES Bulletin 861.

(Table 1) were based on yields of forages grown alone.

Estimates of monthly distribution of dry matter production of specified forages (Appendix II, Table 1) were based on clipping data. Grazing animals will not consume all available forage because of trampling, spot grazing, and spoilage; therefore, a factor to reflect the amount of forage consumed was required. We used factors of 50% for perennial pasture (e.g., coastal bermuda and fescue), 65% for annual pastures (e.g., ryegrass and sorghum x sudan), 80% for hay, and 90% for silage (Appendix II, Table 2).

Combined data on DM production, use rates, DP, and kilocalories (Kcal) of digestible energy per kilogram were the basis for the nutrient input-output coefficients used in the LP model.

Assumptions

Calculating optimal solutions with an LP model of the type and size used in this study requires exact specification of assumptions. The assumptions underlying the basic LP model used in this study were:

(1) labor restricted to two man-equivalents per month but charged at $2.30 per hour for actual hours of employment,
(2) operating capital available in specified quantities and charged at 9% for six months of each year,
(3) calves of specified weights purchased in fall or spring at specified prices,
(4) nutritional requirements of cattle satisfied by combinations of pasture, hay, silage, and supplemental feeds,
(5) hay and/or silage crops grown specifically for beef production and not saleable,
(6) supplemental feeds---corn, cottonseed meal, finishing ration---purchased at

Table 1. Forages incorporated into linear programming models for determining profit-maximizing combinations of enterprises for alternative systems for growing and finishing calves on forage in the Upper Coastal Plain of Mississippi, with estimates of their maintenance cost per acre, 1977.

Forage	Maintenance Cost/acre
	(dollars)
Grazed Forages	
Ryegrass	75.26
Ryegrass-Clover	60.71
Ryegrass-Wheat	83.69
Wheat	80.57
Fescue	52.36
Fescue-Clover	41.82
Coastal Bermuda	77.91
Coastal Bermuda-Clover	70.68
Coastal Bermuda-Clover-Ryegrass	142.81
Common Bermuda	59.88
Common Bermuda-Ryegrass	117.30
Common Bermuda-Early Seeded Ryegrass	130.59
Dallis-Clover	49.54
Sorghum x Sudan	81.79
Silages	
Corn	154.90
Sorghum	146.22
Hays	
Coastal Bermuda	142.81
Common Bermuda	111.61
Sorghum x Sudan	125.40

SOURCE: [4]

Table 2. Constraints imposed upon 11 linear programming models for determining profit-maximizing combinations of enterprises for alternative systems for growing and finishing calves on forage, by model number, Upper Coastal Plain of Mississippi, 1977.

Model Number	Maximum Operating Capital Allowed	Silage Allowed	Average Daily Gain
	Dollars		Pounds
1	Unrestricted	Yes	1.0 and 2.0
2	100,000	Yes	1.0 and 2.0
3	100,000	No	1.0 and 2.0
4	50,000	Yes	1.0 and 2.0
5	50,000	No	1.0 and 2.0
6	100,000	Yes	1.0 and 2.0
7	100,000	No	1.0 and 2.0
8	100,000	Yes	2.0
9	100,000	No	2.0
10	100,000	Yes	1.0
11	100,000	No	1.0

Table 3. Optimum cattle growing and finishing systems, 11 linear programming models (arrayed by level of returns), Upper Coastal Plain of Mississippi, 1977.

			Model Number								
Item	**6**	**8**	**7**	**1**	**2**	**9**	**4**	**3**	**10**	**5**	**11**
	-----	--------	------------	------------	------------	Number	------------	------------	------------	------------	
Cattle Production System											
Buy Oct.-Nov. (300 Lbs.)	414	400	401	340	412	377	226	402	584	224	557
Buy Oct.-Nov. (500 Lbs.)							14				
Buy Apr.-May (500 Lbs.)				198	26						
Graze Nov.-Apr. (2.0 Lbs. ADG)	386	400	354	184	298	377	221	267		153	
Graze May-Oct. (2.0 Lbs. ADG)	386	400	354	184	298	377	221	267		153	
Sell in October (1020 Lbs.)	386	400	354	184	298	377	221	267		153	
Graze May-Oct. (2.0 Lbs. ADG)				198	26						
Graze Nov.-Apr. (2.0 Lbs. ADG)				198	26						
Sell in April (1220 Lbs.)				198	26						
Graze Nov.-Apr. (1.0 Lb. ADG)							14				
Graze May-Oct. (2.0 Lbs. ADG)							14				
Sell in October (1040 Lbs.)							14				
Graze Nov.-Apr. (1.0 Lb. ADG)	28										
Sell in April (480 Lbs.)	28										
Graze Nov.-Apr. (1.0 Lb. ADG)			47				5		584	71	557
Graze May-Oct. (1.0 Lb. ADG)			47				5		584	71	557
Sell in October (660 Lbs.)			47				5		584	71	557
Graze Nov.-Apr. (1.0 Lb. ADG)				156	114			135			
Graze May-Oct. (1.0 Lb. ADG)				156	114			135			
Graze Nov.-Apr. (1.0 Lb. ADG)				156	114			135			
Sell in April (1020 Lbs.)				156	114			135			
	-----	--------	------------	------------	------------	Dollars	------------	------------	------------	------------	
Operating capital requirement	88,591	89,556	100,000	142,631	100,000	100,000	50,000	100,000	100,000	50,000	100,000
Returns to Land, Management, and General Farm Overhead: Total	49,126	49,064	35,406	52,751	51,585	33,648	31,498	40,537	19,941	19,042	15,405
Annual Rate	(49,126)	(49,064)	(35,406)	(35,167)	(34,390)	(33.648)	(31,498)	(27,025)	(19,941)	(19,042)	(15,405)

specified prices ($7 cwt for corn, $12 cwt for CSM, $7 cwt for the finishing ration),

(7) silage available for feeding in any month but hay available for feeding only in September through May,

(8) sale of cattle permitted at the end of each stage of each alternative production system,

(9) average daily gain of 1.0 or 2.0 pounds in each 180-day grazing period, 2.5 pounds in each 60-day feeding period, and

(10) land suitable for improved pasture, hay, or silage limited to 360 acres.

Eleven models (three permitting up to a complete 2-year cycle and eight permitting up to a complete 1-year cycle) were developed. Constraints imposed upon the different models are presented in Table 2.

ANALYSIS AND RESULTS

The linear-programming matrix included the 19 forage alternatives shown previously in Table 1 and 54 cattle alternatives[5]---along with the monthly forage and supplemental feeding activities, buying and selling activities, and transfer activities needed to complete the model. Models 1, 2, and 3 were structured to cover a maximum time period of two years to allow sufficient time for the slowest-gaining animals (1.0 pound ADG) to grow to a finished weight. Models 4-11 were struc-

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[5] *The 54 alternative systems for growing and finishing calves on forage are described in Appendix I Detailed cost and return budgets for each alternative were developed as shown in Appendix II, Table 3.*

Table 4. Forage and feed requirements for optimum cattle growing and finishing systems, 11 linear programming models (arrayed by level of returns), Upper Coastal Plain of Mississippi, 1977.

			Model Number								
Item	6	8	7	1	2	9	4	3	10	5	11
	Acres										
Forage Enterprise											
Grazed Forage (First two 180-day grazing periods)											
Ryegrass						42					
Ryegrass-Wheat	130	126	175	155	135	138		193	12	103	
Sorghum x Sudan	99	107	123	142	124	115	44	113	89	61	87
Fescue-Clover	6	12	3			23	135		146	19	169
Coastal-Clover	38	30	1								
Hay (First two 180-day grazing periods)											
Sorghum x Sudan	15	14	58	3	54	42		54	82	28	104
Silage (First two 180-day grazing periods)											
Corn Silage	72	71		60	47		63		31		
Hay (Third 180-day grazing period)											
Sorghum x Sudan								88			
Silage (Third 180-day grazing period)											
Corn Silage				11							
Sorghum Silage				139	62						
Total Land Used (First two 180-day grazing periods)	360	360	360	360	360	360	242	360	360	211	360
Total Land Used (Third 180-day grazing period)	—	—	—	150	62	—	—	88	—	—	—
	tons										
Purchased Feed (First two 180-day grazing periods)											
Corn Grain	22	38	121			151	7			33	40
Cottonseed Meal	10	12	14			16	5			5	
	dollars										
Return to Land, Management, and General Farm Overhead:											
Total	49,126	49,064	35,406	52,751	51,585	33,648	31,498	40,537	19,941	19,042	15,405
Annual Rate	(49,126)	(49,064)	(35,406)	(35,167)	(34,390)	(33,648)	(31,498)	(27,025)	(19,941)	(19,042)	(15,405)

tured to cover only one year (two 180 day grazing periods). The general format for the cattle cost and returns budget and the cattle buying and selling prices used are shown in Appendix II, Tables 3 and 4.

The optimum systems determined from the 11 linear programming models are shown in Table 3. The most profitable system resulted from Model 6, and consisted of buying 414 head of 300-lb. calves in Oct.-Nov., grazing 386 of them at 2.0 lbs ADG for two 180-day periods, and selling the 386 in October at 1020 lbs. The other 28 calves were grazed for 180 days at 1.0 lb ADG and sold in April at 480 lbs. Net returns were $49,126.[6]

While Model 6 provided the highest return, it involves a more complex program, using both 1.0 and 2.0 lb rates of gain. Model 8 provides a net return of $49,064 (only $62 less) and uses only the 2.0 lb rate of gain. This more practical system buys 400 head of 300-lb calves in Oct.-Nov., grazes for two 180-day periods at 2.0 lbs ADG, and sells at 1020 lbs. in October. The detailed cost and returns budget for Model 8 is shown in Appendix II, Table 5.

Operating capital requirements for each optimum system are also shown in Table 3. Inclusion of silage (Models 6 and 8, for example) resulted in less operating capital required than in similar models excluding silage (Models 7 and 9, for example). Monthly operating capital flows are shown in Appendix II, Table 7.

Forage and feed requirements for all of the optimum systems are shown in Table 4. In Model 8, for example, nutritional requirements are met by grazing 126 acres of ryegrass-wheat, 107 acres of sorghum x sudan, 12 acres of fescue-clover, and 30 acres of coastal-clover. Hay is produced from 14 acres of sorghum x sudan, and corn silage is produced from 71 acres. Purchased feed consists of 38 tons of grain and 12 tons of cottonseed meal. Details of feed requirements and sources by month for the Model 8 system are shown in Appendix II, Table 6.

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[6] *Net returns after paying all costs except land, management, and general farm overhead.*

The results of this study suggest several general conclusions. First, growing and finishing calves on high quality forages can be a profitable alternative for Mississippi producers. Second, buying lighter calves to use in higher rate of gain programs is more profitable. Third, production of corn silage as a basic part of the feed ration adds to net returns--- and also reduces operating capital requirements. Finally, the realization of the study results in an actual situation will require management capable of producing high quality forage and of obtaining high rates of cattle gain.

APPENDIX I

Alternative Systems for Growing and Finishing Calves on Forage

300-POUND CALVES (fall bought)

1. Winter graze 180 days at 1.0 pound ADG, sell at 480 pounds.
2. Winter graze 180 days at 2.0 pounds ADG, sell at 660 pounds.
3. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, sell at 660 pounds.
4. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, sell at 840 pounds.
5. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, sell at 840 pounds.
6. Winter graze 180 days at 1.0 pound ADG, summer graze at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell at 840 pounds.

*7. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 2.0 pounds ADG, sell at 1020 pounds.

8. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1020 pounds.
9. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, winter graze 180 days at 1.0 pound ADG, sell at 1020 pounds.
10. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell at 1020 pounds.
11. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, sell at 1020 pounds.

*Model 8 solution.

12. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1200 pounds.
13. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1200 pounds.

400-POUND CALVES (fall bought)

14. Winter graze 180 days at 1.0 pound ADG, sell at 580 pounds.
15. Winter graze 180 days at 2.0 pounds ADG, sell at 760 pounds.
16. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, sell at 760 pounds.
17. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, sell at 940 pounds.
18. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, sell at 940 pounds.
19. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell at 940 pounds.
20. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, finishing ration 60 days at 2.5 pounds ADG, sell at 1090 pounds.
21. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, finishing ration 60 days at 2.5 pounds ADG, sell at 1090 pounds.
22. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG,

finishing ration 60 days at 2.5 pounds ADG, sell at 1090 pounds.

23. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 2.0 pounds ADG, sell at 1120 pounds.
24. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1120 pounds.
25. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, winter graze 180 days at 1.0 pound ADG, sell at 1120 pounds.
26. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell at 1120 pounds.

500-POUND CALVES (fall bought)

27. Winter graze 180 days at 1.0 pound ADG, sell at 680 pounds.
28. Winter graze 180 days at 2.0 pounds ADG, sell at 860 pounds.
29. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, sell at 860 pounds.
30. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, sell at 1040 pounds.
31. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 1.0 pound ADG, sell at 1040 pounds.
32. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell at 1040 pounds.
33. Winter graze 180 days at 2.0 pounds ADG, summer graze 180 days at 2.0 pounds ADG, sell at 1220 pounds.
34. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1220 pounds.

500-POUND CALVES (spring bought)

35. Summer graze 180 days at 1.0 pound ADG, sell at 680 pounds.
36. Summer graze 180 days at 2.0 pounds ADG, sell at 860 pounds.
37. Summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell at 860 pounds.
38. Summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1040 pounds.
39. Summer graze 180 days at 2.0 pounds ADG, winter graze 180 days at 1.0 pound ADG, sell at 1040 pounds.
40. Summer graze 180 days at 1.0 pound ADG, winter graze at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, sell at 1040 pounds.
41. Summer graze 180 days at 2.0 pounds ADG, winter graze 180 days at 2.0 pounds ADG, sell at 1220 pounds.
42. Summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 2.0 pounds ADG, sell at 1220 pounds.

600-POUND CALVES (fall bought)

43. Winter graze 180 days at 1.0 pound ADG, sell at 780 pounds.
44. Winter graze 180 days at 2.0 pounds ADG, sell at 960 pounds.
45. Winter graze 180 days at 1.0 pound ADG, summer graze 180 days at 1.0 pound ADG, sell at 960 pounds.
46. Winter graze 180 days at 2.0 pounds ADG, finishing ration 60 days at 2.5 pounds ADG, sell at 1110 pounds.
47. Winter graze 180 days at 1.0 pound ADG summer graze 180 days at 1.0 pound ADG finishing ration 60 days at 2.5 pounds ADG, sel at 1110 pounds.
48. Winter graze 180 days at 1.0 pound ADG summer graze 180 days at 2.0 pounds ADG, sel at 1140 pounds.

600-POUND CALVES (spring bought)

49. Summer graze 180 days at 1.0 pound ADG, sel at 780 pounds.
50. Summer graze 180 days at 2.0 pounds ADG, sel at 960 pounds.
51. Summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, sell a 960 pounds.
52. Summer graze 180 days at 2.0 pounds ADG, finishing ration 60 days at 2.5 pounds ADG, sell at 1110 pounds.
53. Summer graze 180 days at 1.0 pound ADG, winter graze 180 days at 1.0 pound ADG, finishing ration 60 days at 2.5 pounds ADG, sell at 1110 pounds.
54. Summer graze 180 days at 1.0 pound ADG winter graze 180 days at 2.0 pounds ADG, sell a 1140 pounds.

APPENDIX II

Appendix II, Table 1. Estimated dry matter production, by month, in pounds per acre for selected forages, Upper Coastal Plain of Mississippi.

Forage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ryegrass	600	700	1,200	1,200	550							
Ryegrass-Clover		600	1,200	1,200	600							
Ryegrass-Wheat	600	700	1,200	1,200	550						750	650
Wheat			1,000	1,200	500						750	650
Fescue	150	150	500	1,100	1,000	600	200	200	250	350	300	200
Fescue-Clover	160	180	600	1,600	1,480	800	250	250	400	480	300	200
Coastal Bermuda				350	2,100	2,600	3,200	1,550	1,400	800		
Coastal-Clover		500	722	1,317	2,181	1,995	1,958	1,066	951	636	400	
Coastal-Ryegrass	275	500	900	1,038	1,460	1,779	2,714	1,266	951	492	275	275
Dallis-Clover	75	150	250	750	1,200	1,500	1,200	800	250	150	100	75
Common Bermuda				300	1,300	1,700	1,800	700	500	200		
Common-Ryegrass	275	500	900	1,038	1,100	1,500	1,700	600	450	150		
Common-Early Ryegrass	275	500	900	1,038	1,100	1,500	1,700	600				
Sorghum x Sudan					1,000	2,500	2,800	2,800	1,000	600		
Coastal Bermuda Hay						4,000	3,200	1,550	1,440			
Common Bermuda Hay						3,000		2,500	1,200			
Sorghum x Sudan Hay						3,500	2,800	2,800	1,000			
Corn Silage								9,100				
Sorghum Silage									10,500			

Source: [4]

Appendix II, Table 2. Utilization rate[1], digestible protein[2], and digestible energy[2] for selected forages, Upper Coastal Plain of Mississippi.

Forage	Utilization rate[1]		Digestible protein[2]		Digestible energy[2]	
	1st	2nd[a]	1st	2nd[a]	1st	2nd[a]
	----------(percent)---------				(K cal./kg.)	
Ryegrass	65	---	11.7	---	3,000	---
Ryegrass-Clover	65	---	14.6	---	3,021	---
Ryegrass-Wheat	65	---	11.5	---	3,000	---
Wheat	65	---	11.2	---	3,000	---
Fescue	50	---	10.7	---	2,850	---
Fescue-Clover	50	---	12.8	---	2,908	---
Coastal Bermuda	50	---	10.7	---	2,960	---
Coastal-Clover	50	---	11.1	---	2,932	---
Coastal-Ryegrass	50	65	11.0	11.7	2,960	3,000
Dallis-Clover	50	---	11.6	---	3,131	---
Common Bermuda	50	---	7.8	---	2,822	---
Common B-Ryegrass	50	65	7.8	11.7	2,822	3,000
Common B-Early Ryegrass	50	65	7.8	11.7	2,822	3,000
Sorghum x Sudan	65	---	12.0	---	3,050	---
Coastal Hay	80	---	7.0	---	2,610	---
Common Bermuda Hay	80	---	7.0	---	2,116	---
Sorghum x Sudan Hay	80	---	7.0	---	2,600	---
Corn Silage + urea	90	---	8.0	---	3,086	---
Sorghum Silage + urea	90	---	5.0	---	2,478	---

[a] Forage combinations in which the growing season for each of the forages in the combination can be distinctly separated will have two separate figures for utilization rate, percent digestible protein, and energy content.

[1] Based on discussions with H. W. Essig, Animal Scientists, MAFES Department of Animal Science

[2] Developed from NAS-NRC Published Data [5] and Data Published by Crampton and Harris [2].

Source: [4]

Appendix II, Table 3. Beef cattle: Representative expenses for calves for six-month grazing periods.[a]

Item	Unit	Quantity	Price/unit	Amount
Calves	cwt.	b	c	d
Order buying	cwt.	e	.25	e
Death loss	head	1.0	f	f
Vet., medicine, minerals, etc.	cwt.	g	g	g
Labor[h]	hour	1.68	2.30	3.86
Interest on operating capital	head	1.00	i	i

[a] Budgets for 54 livestock activities were prepared from this general table by inserting appropriate weights, etc. This representative table is presented in lieu of the 54 budgets.

[b] Budgets were developed for 300, 400, 500, and 600 pound fall-purchased calves and 500 and 600 spring-purchased calves gaining at 1.0 and 2.0 pounds per day.

[c] See Appendix Table 4.

[d] Weight x purchase price.

[e] For purchase weights 300, 400, 500, and 600 pounds. No charge for transferred animals.

[f] Three percent of the selling price.

[g] $1.00/cwt. for purchased animals; $.50/cwt. for transferred animals.

[h] Includes inspection of animals on pasture, treatment of sick animals, etc.

[i] Nine percent for six months.

Appendix II, Table 4. Estimated cattle buying and selling data.

BUYING

Animal weight	Price/cwt.	Order buying fee	Total amount
300# (Fall)	$38.50	$.25 cwt.	$116.25
400# (Fall)	38.75	.25 cwt.	156.00
500# (Fall)	37.25	.25 cwt.	187.50
600# (Fall)	37.25	.25 cwt.	225.00
500# (Spring)	37.25	.25 cwt.	187.50
600# (Spring)	37.25	.25 cwt.	225.00

SELLING

Animal weight	Price/cwt.	Death loss (3%)	Total amount
480#	$36	$ 5.88	$166.92
580#	36	6.26	202.54
660#	35	6.93	224.07
680#	35	7.14	230.86
760#	33	7.52	243.28
780#	33	7.72	249.68
840#	32	8.06	260.74
860#	32	8.25	266.95
940#	35	8.87	319.13
960#	35	10.08	325.92
990#	36	10.69	345.71
1020#	38	11.62	375.98
1090#	38	12.42	401.78
1110#	38	12.65	409.15
1120#	38	12.76	412.84
1040#	38	11.85	383.35
1220#	38	13.90	449.70
1140#	38	12.99	420.21

Appendix II, Table 5. Estimated costs and returns for an optimum growing and finishing system (Model 8), Upper Coastal Plain of Mississippi, 1977.

Item	Unit	Quantity	Price/unit	Amount
Income				
Calves	head	388.00	387.60	$150,388
Expenses				
Cattle				
Calves	head	400.00	114.00	45,600
Order buying	head	400.00	.75	300
Death loss	head	12.00	387.60	---
Vet., medicine, minerals, misc., etc.	head	400.00	6.30	2,640
Labor	head	400.00	7.72	3,088
Grazed forages				
Ryegrass-Wheat	acre	126.00	80.41 [a]	10,132
Fescue-Clover	acre	12.00	40.50 [a]	486
Sorghum x Sudan	acre	107.00	78.57 [a]	8,407
Coastal-Clover	acre	30.00	68.52 [a]	2,056
Hay				
Sorghum x Sudan	acre	14.00	121.30 [a]	1,698
Feeding	ton	56.00	2.51	141
Silage				
Corn Silage	acre	71.00	162.07 [ab]	11,507
Feeding	ton	923.00	2.76	2,548
Purchased feed				
Corn grain	ton	38.00	140.00	5,320
Cottonseed meal	ton	12.00	240.00	2,880
Interest on operating capital	dollar	89,556.00	.045	4,030
Return to land, management, and general farm overhead				$49,555 [c]

[a] Cost excluding interest.

[b] Cost includes storage.

[c] Enterprise quantities have been numerically rounded causing differences between net returns reported here and in the text tables.

Appendix II, Table 6. Monthly requirements and sources of digestible energy for an optimum growing and finishing system (Model 8), Upper Coastal Plain of Mississippi, 1977.

	Unit	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
Energy requirement -400 calves -	1,000 Mcal	152.8	179.2	200.0	198.0	238.0	248.4	274.0	282.8	309.6	327.2	333.2	361.2
Energy sources													
Ryegrass-Wheat (126 acres)	1,000 Mcal	84.6	72.2	66.5	77.9	133.4	133.4	61.2					
Fescue-Clover (12 acres)	1,000 Mcal	3.2	1.6	1.3	1.4	4.7	12.7	11.7	6.3	2.0	2.0	3.2	3.8
Sorghum x Sudan (107 acres)								96.1	240.1	269.1	269.2	96.2	68.0
Coastal-Clover (30 acres)	1,000 Mcal	7.9			9.8	14.3	14.1	43.0	39.3	38.5	21.1	18.8	12.5
Sorghum x Sudan	1,000 Mcal			16.6									102.5
hay (14 acres)	ton			7.8									48.3
Corn Silage	1,000 Mcal	8.0	81.2	111.2	75.1	64.8	88.2	62.0			35.0	209.0	171.5
(71 acres)	ton	8.1	82.8	113.3	76.5	66.0	89.8	63.0			35.6	213.2	174.8
Corn grain	1,000 Mcal	48.0	20.1		29.8	20.8							
(38 tons)	ton	15.6	6.4		9.5	6.6							
Cottonseed meal	1,000 Mcal	1.1	4.1		4.4	4.1						6.0	13.7
(12 tons)	ton	.4	1.5		1.6	1.5						2.2	5.0
Total digestible energy	1,000 Mcal	152.8	179.2	200.0	198.0	238.0	248.4	274.0	285.7	309.6	327.2	333.2	372.0

Appendix II, Table 7. Monthly operating capital flows for optimum one-year growing and finishing systems, Upper Coastal Plain of Mississippi, 1977.

Model number	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.
4	-30,736	-561	-586	-749	-3,156	-6,828	-1,506	-153	-956	-2,504	-755	+88,432
5	-26,935	-1,076	-167	-323	-1,982	-4,332	-824	-599	-1,457	-1,206	-10,331	+72,667
6	-51,352	-1,944	-706	-1,294	-2,695	-6,352	-2,318	-1,321	-2,381	-3,704	-7,931	+143,211
7	-49,474	-3,088	-1,621	-2,087	-3,415	-8,842	-1,575	-1,235	-2,918	-2,394	-19,479	+139,579
8	-50,249	-2,499	-738	-1,998	-3,459	-11,326	-2,351	-1,127	-2,357	-3,716	-7,774	+148,451
9	-47,257	-4,068	-1,971	-2,501	-4,336	-7,785	-1,510	-946	-2,550	-2,722	-19,312	+136,704
10	-70,081	-547	-470	-462	-4,081	-10,473	-2,056	-1,749	-3,140	-3,410	-2,110	+129,439
11	-66,882	-439	-450	-444	-4,304	-8,975	-1,694	-2,090	-3,482	-2,729	-6,987	+123,287

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Tall Fescue in Mississippi

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Tall Fescue in Mississippi

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Tall fescue (*Festuca arundinacea* Schreb.) is the most widely grown, cool-season perennial forage grass in Mississippi (Figure 1), particularly north of I-20 where most of the 300,000 acres of fescue pasture in the state is found. It is one of the more popular perennial grasses in beef cattle-forage systems but is used only infrequently as forage for lactating dairy cows.

Fescue will grow when average temperature is as low as 34°F, but does best at temperatures above 40°F. However, growth is retarded in summer unless adequate moisture is available. Therefore, its dependability for forage production is greatest from October through June.

These are major advantages of tall fescue:

(1) The dense sod produced by the vigorous root system resists breakthrough of animal hooves, especially in winter and early spring when pastures are subject to the most severe damage from animal traffic.

(2) It is quite drought resistant because of its deep root system.

(3) It tolerates wet soils and submersion.

(4) It is more tolerant of alkaline conditions than are many other cool-season grasses.

Major disadvantages are

(1) It is less palatable than most winter annual grasses, especially at advanced stages of growth.

(2) Stands thin with heavy cutting or grazing.

(3) Its slow growth under high temperature-low rainfall conditions supports only limited animal performance from July through September.

(4) It can crowd out clover.

(5) Cattle grazing fescue pastures or consuming fescue hay are susceptible to fescue toxicity.

Good management can overcome some of the problems, and growing clover in fescue is one of the most effective practices. In addition to overcoming or minimizing problems encountered with fescue grown in pure stands, growing clover in fescue increases the quantity and improves the quality of forage, and reduces the amount of

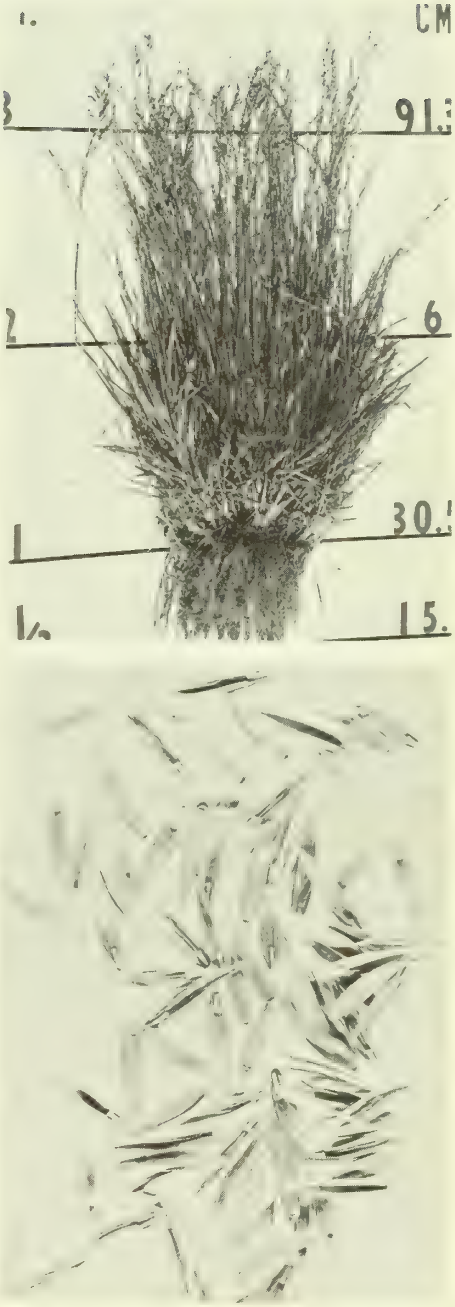

Figure 1. Mature tall fescue plant showing the typical robust growth, coarse texture, dense root system, flat leaves and seed head (top); and tall fescue seed (bottom).

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commercial nitrogen required for pasture maintenance.

The following guidelines for establishing and managing fescue pastures are based on results of a number of MAFES studies designed for determining ways of improving the use of tall fescue in beef cattle-forage systems.

PRODUCTION AND MANAGEMENT GUIDELINES [1]

Establishment and Maintenance

Soil Selection---Tall fescue grows well on many soils, but does best on a fertile, moist, fine-textured soil. It will tolerate wet soil and submersion, but these areas should be avoided when possible. Fescue will produce satisfactorily on soil with pH of 4.7 to 8.5, but optimum growth occurs in the 5.5 to 7.0 pH range. Fescue-clover pastures require soil with pH of 6.0 to 7.0.

Fertilization---Apply lime, phosphate and potash to soil test recommendations. In the absence of a soil test apply 60 to 90 pounds of P_2O_5 and K_2O per acre in a 1:1 ratio for establishment, and 40 to 60 pounds per acre in a 1:1 ratio each year thereafter.

High rates of nitrogen are required for high yields. Best results can be expected when equal amounts of nitrogen are applied in fall and spring. Our trials have demonstrated that dry matter production increases with each increase in nitrogen level up to 240 lb/acre (Table 1). However, tall fescue and white clover grown together with no added nitrogen have produced about the same dry matter yields as fescue grown alone with annual applications of 180 lbs of nitrogen per acre.

Seedbed Preparation---Tall fescue grows best in soil tilled 4 to 6 inches deep, then leveled and firmed before planting. It also may be sod-seeded into bermudagrass pastures.

Varieties---Seed of eight commercial varieties of tall fescue have been released (Table 2) and three of these are now recommended for production in Mississippi. 'Kentucky 31' has been the most productive in our tests (Table 3). 'Alta' and 'Goar' produce less dry matter than Kentucky 31, but may be more nutritious. 'Fawn', 'Kenhy' and 'Missouri 96' are now under test in Mississippi.

Planting---Plant between Sept. 1 and Nov. 1, using 15 lbs of high-quality seed per acre, seeded ¼ to ½-in. deep. Seed into bermudagrass sod at the same rate and depth on Oct. 15.

When planting fescue-clover combinations (Figure 2), drill 10 lbs of fescue seed ¼- to ½-inch deep in 20-inch rows and broadcast 3 lbs of white clover[2] seed or 6 to 8 lbs of red clover[2] seed. Inoculate the clover seed with the correct strain of *Rhizobium* just before planting. Be sure to place the seed in direct contact with the inoculum. This normally is accomplished by using a sugar-water solution to stick the inoculum to seed; however, commercial stickers are available.

Table 1. Forage production of tall fescue fertilized with different rates of nitrogen, Mississippi State University, 1965-1969.

Nitrogen rate	Forage Production[1]
Lbs/A	Lbs/A
0	1680 e
60[2]	1920 e
90	3117 d
120	4131 c
180	4179 bc
240	6567 a
Fescue-white clover with no nitrogen added	4897 b

[1]Means in a column followed by a different letter differ at the 5% level of probability as determined by Duncan's Multiple Range Test.

[2]Nitrogen at each rate applied either in spring and fall or split (spring-fall).

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[1] *The guidelines presented and the varieties recommended in this bulletin are based on the latest MAFES research results available at the time of printing. Refer to the latest* **Crop and Fertilizer Guidelines for Mississippi** *or consult your area or county Cooperative Extension Service personnel to determine whether the guidelines and recommended varieties have been changed.*

[2] *Refer to the latest* **Crop and Fertilizer Guidelines for Mississippi** *or consult your area or county Cooperative Extension Service personnel for variety recommendations.*

Table 2. Commercial tall fescue varieties, by date of release, source of release and varietal characteristics.

Variety	Year Introduced	Released By	Characteristics
Kentucky 31	Early 1940's	Kentucky AES	Most popular variety, grows on wide range of soils, and over a wide temperature range, highly productive, low palatability
Alta	1940	Oregon AES and USDA	Resistant to cold and drought, production similar to Kentucky 31
Goar	1946	California AES and SCS	Early maturity, vigorous, adapts to heavy-textured alkaline soils, grows better in hot weather than other varieties
Kenmont	1963	Montana AES	Similar in appearance to Kentucky 31, but sod slightly denser
Fawn	1964	Oregon AES	Improved digestibility and higher in crude protein, improved seed yield, more vigorous
Kenwell	1965	Kentucky AES and USDA	Improved palatability and quality, disease resistant, later maturity, better with legumes
Kenhy	1977	Kentucky AES and USDA	Ryegrass-tall fescue hybrid derivative, more palatable and digestible, drought tolerant, widely adapted, better cattle gains
Missouri 96	1978	Missouri AES	Cattle gain 35-40% higher, dairy cattle intake higher than on Kentucky 31, Fawn or Kenhy

Management

Realizing the potential of tall fescue in a beef cattle-forage system requires high levels of management. Areas of major concern are (1) maximizing yields of quality forage without stand thinning, (2) seed production and (3) minimizing fescue toxicity problems.

Yield, Quality and Stand Maintenance---One strategy for managing established stands of tall fescue is to apply phosphate, potash and nitrogen to pastures in early September and let parts of the pasture grow (stockpile) until January or February before grazing. However, cattle grazing stockpiled fescue are more susceptible to fescue toxicity. Also, stockpiling of fescue-clover combinations is not practical because the rank fescue growth resulting from deferred grazing will eliminate most clovers.

Rates of forage accumulation in a two-year stockpiling experiment with pure stands of tall fescue increased from September through December, decreased slightly in January and February, and then increased through maturity (Table 4). However, most of the total yield was produced in the first two months after fertilization. Digestibility of the forage was acceptable at all stages of growth, but percentages of green leaves, crude protein content and sugar content decreased as the fescue grew. Therefore, maintenance of beef cows on stockpiled tall fescue pastures requires protein supplementation, and this management strategy as part of a total forage program should be restricted to animals that do not require a high-quality ration.

Tall fescue-clover combinations yield most when the forage is removed to a stubble height of about 1-inch when the fescue is no taller than 12 inches. Yields of tall fescue-white clover stands in three years of testing were higher when cut to 1-inch stubble height than to 3 inches (Table 5). However, the clover tended to crowd out the fescue, and cutting to a stubble height of 3 inches maintained fescue stands and restrained clover to the 30 to 50% level (Figure 3) that most producers consider desirable.

Regal white clover-tall fescue pastures provided 60 days more grazing than tall fescue alone at the MAFES Brown Loam Branch. Cows on clover-fescue produced fall calves that weaned at 544 lbs. Fall calves from cows on a two-pasture system of bermudagrass-dallisgrass in summer and wheat-ryegrass in winter were weaned at 523 lbs. Winter-calving cows on the

Figure 2. Tall fescue-white clover combinations are popular in Mississippi. Jack Wesli (left), manager of the cooperating farm; W. E. Knight (center), USDA agronomist; and Vance H. Watson are pictured in a tall fescue-white clover pasture near Columbus.

Table 3. Dry matter yields of tall fescue, by variety, Mississippi, 1967-69.

	Dry matter yield		
	1967	**1968**	**1969**
		Lbs/A	
Kentucky 31	5959	5483	6021
Alta	5743	5088	5544
Kenmont	5693	5332	5026
Kenwell	5126	4884	5210
Goar	5819	5207	5462
Ky 45-50*	5720	5077	4369
LSD (.05)	N.S.	N.S.	N.S.

***Experimental strain, not released**

Table 4. Yield accumulation and quality of tall fescue in stockpiling trials, by month, Mississippi State University, 1968.

		Quality Measures			
Month	**Dry matter accumulation**	**Green Leaves**	**Crude Protein**	**Carbo-hydrates**	**Digestibility**
	Lbs/A	%			
October[1]	1550	69.8	12.6	8.6	69.7
November	3690	73.8	9.2	14.5	71.5
December	4259	37.2	8.8	13.8	72.9
January	3489	33.9	7.0	9.1	74.2
February	3795	29.4	6.3	7.3	67.4
March	4161	39.6	6.5	6.5	66.4
April	4861	58.4	6.5	9.3	68.5
May	4240	43.8	6.1	12.3	62.8
June	4789	40.6	5.6	7.0	58.0

[1] A two-year-old sod of tall fescue was clipped in late August and fertilized with nitrogen in September. Values presented are the average of three nitrogen levels.

Table 5. Forage yields of tall fescue-white clover stands and estimated percentages of clover in the stands after three years of testing, by fescue row spacing,[1] height of stands at time of cutting and height of stands after cutting, Mississippi State University, 1966-68.

Height of Fescue at time of cutting	Stubble Height	Dry matter yield (three-year averages)				Clover in stands (after three years of testing)			
		Fescue rows spaced at				Fescue rows spaced at			
		10 inches	20 inches	broad-cast	All spacings[2]	10 inches	20 inches	Broad-cast	All spacings[2]
		Lbs/A				%			
6 inches	1 inch	7250	6858	6505	6871 a	75.0	70.0	73.8	72.9 a
6 inches	3 inches	5720	5621	5157	5499 b	45.0	32.5	66.7	48.1 b
12 inches	1 inch	6890	7133	6475	6833 a	83.7	75.0	80.0	79.5 a
12 inches	3 inches	5757	5673	5170	5533 b	53.8	33.8	55.0	47.5 bc
Heading (then 6 inches)	3 inches	5581	4882	4994	5152 b	51.3	47.5	53.8	50.8 b
6 inches	1 inch (no summer cut)	6722	6408	6501	6544 a	38.8	35.0	47.5	40.4 c

[1] Fescue seeded at 15 pounds per acre in 10-inch rows, 20-inch rows and by the conventional broadcast method; white clover broadcast in all fescue seedings at 3 pounds per acre.

[2] Means in a column followed by a different letter differ at the 5% level of probability as determined by Duncan's Multiple Range Test.

clover-fescue required only 60 days of winter feeding, those on the two-pasture grass system required 116 days.

The early bloom stage is the best time for cutting tall fescue for hay. This normally is in early May in central and north Mississippi where most of the fescue in the state is grown.

Seed Production---Tall fescue produces one crop of seed each year and grazed fescue sods can be used for seed production, with highest yields obtained from pure fescue stands. The most important factors affecting seed yield and quality (Figure 4) are levels of nitrogen applied and removal of cattle from pastures by March 30 (Tables 6 and 7).

Seed can be harvested by direct combining of standing plants or by cutting and windrowing for combining later. Ripe fescue seed shatter when harvested by either method, and harvest losses of 35 to 40% are to be expected.

Removing the residue from combining permits grazing the regrowth by early fall or stockpiling it until winter.

Minimizing Fescue Toxicity---Fescue foot is most prevalent in pure stands of tall fescue that are thick and rank. Cattle grazing tall fescue fertilized with more than 200 pounds of nitrogen annually or with large amounts of chicken litter are particularly prone to fat necrosis. Also, fescue pasture may not provide enough energy for pregnant cows, making them more susceptible to fescue toxicity. These

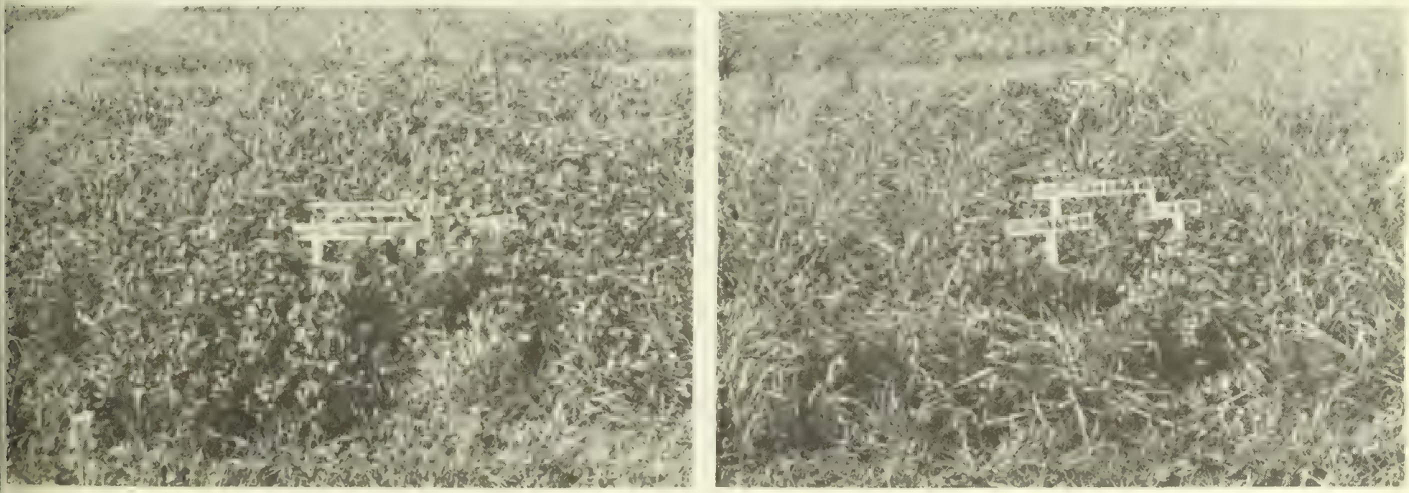

Figure 3. Clover crowded out the fescue in plots clipped to 1-inch stubble height (left) but was restrained to less than 50% of the fescue-clover mixture in plots clipped to 3-inch stubble height (right).

management practices lessen the risk of fescue toxicity:

(1) Use fescue-legume mixtures. Clover improves the quality of forage and minimizes risks of fescue toxicity.

(2) Do not apply nitrogen to fescue-clover mixes and use no more than 200 lbs of nitrogen per acre per year on pure fescue stands.

(3) Do not fertilize fescue with high rates of chicken litter.

(4) Supplement pasture with grain or good quality hay for pregnant cows, and during stress periods such as cold winters.

(5) Graze pastures rotationally and cut excess growth for hay.

Table 6. Forage and seed production and quality of seed produced by tall fescue fertilized with different rates of nitrogen, Mississippi State University, 1967-68.

Nitrogen	Production[1]		Seed
Rate	Forage[2]	Seed	Germination[1]
Lbs/A	------Lbs/A------		%
0	1698 c	111 b	75.4 b
60	4335 b	378 a	85.7 a
120	6712 a	500 a	86.1 a

[1] Means in a column followed by a different letter differ at the 5% level of probability as determined by Duncan's Multiple Range Test.

[2] Dry matter

Table 7. Forage and seed production and quality of seed produced by tall fescue, by date of last harvest before allowing fescue to mature, Mississippi State University, 1967-68.

Date of	Production[2]		Seed
Last Harvest[1]	Forage[3]	Seed	Germination[2]
	------Lbs/A------		%
No Harvest	5278 a	561 a	85.0 a
March 15	4625 a	469 a	85.3 a
March 30	4727 a	471 a	84.5 a
April 15	3455 b	176 b	74.9 b
April 30	3134 b	0 c	---

[1] Last harvest before allowing fescue to mature

[2] Means in a column followed by a different letter differ at the 5% level of probability as determined by Duncan's Multiple Range Test

[3] Dry matter

Fescue Toxicity

Fescue toxicity appears in at least three forms---fescue foot, fat necrosis and poor animal performance (also called summer slump or summer syndrome). No one knows whether these forms of toxicity represent separate problems or are different symptoms of the same problem; whether toxin is produced by fescue or by a fungus growing on fescue. Some cattle are more susceptible than others to fescue toxicity.

Cattle with fescue foot don't gain well and may die, in severe case Rough hair, arched back an soreness in one or both rear legs a early symptoms. Later, skin at t junction with the hoof becomes re and swollen, and the animal ge more and more lame. The tip of t tail may get sore too. Hooves, tail tip and ear tips may slough off in advanced stages, and cattle won't eat well and become emaciated. Animals will recover, in most cases, if the disease is not too advanced. The remedy is to remove the animal immediately from the fescue pasture or hay ration.

Fescue foot usually appears between late fall and early spring, when it is cold, rainy or overcast. The disease has been reported in all parts of Mississippi but not in all counties.

Fat necrosis is sporadic and not easily detected. Lesions of hard fat develop in the abdomens of cattle with the disease, and a weight loss occurs when the lesions begin to interfere with the digestive process. Large accumulations of the hard fat often lead to death. The disease has been reported only in cows that are more than two years old, most often in hot weather after they have grazed fescue for eight or ten months.

Summer slump or summer syndrome is difficult to detect because it usually occurs in late summer under high temperatures, and symptoms are similar to heat stress in cattle. Symptoms are progressively poorer gain, rough hair, scours, rapid respiration, excessive urination and fever. Poor animal performance is of indefinite duration and usually disappears with the onset of cooler weather.

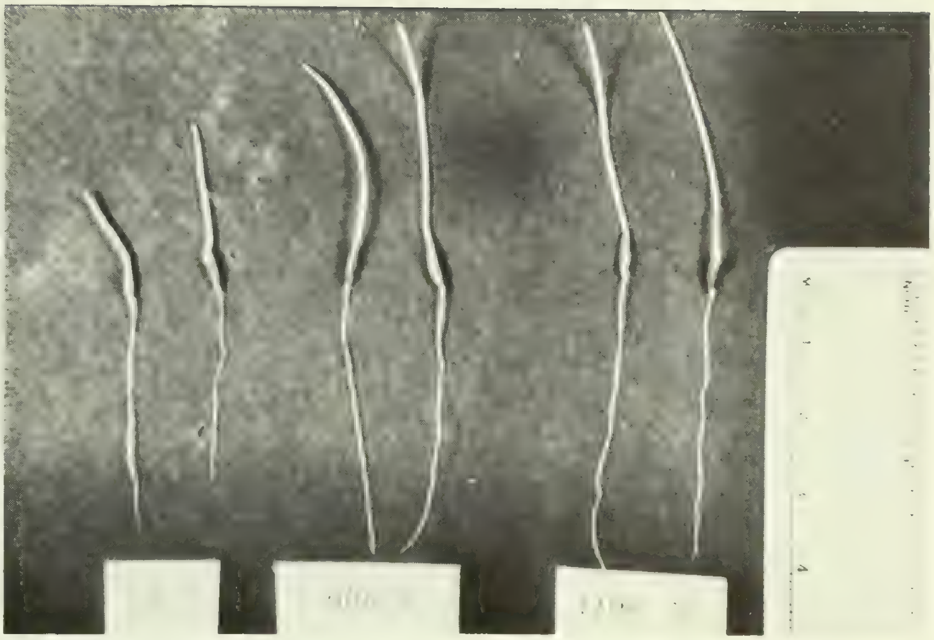

Figure 4. Vigorous tall fescue seedlings (right) show influence of nitrogen on seed quality.

Diseases and Insects

Diseases have not been a major problem in fescue production in Mississippi; however, severe outbreaks of crown rust (caused by *Puccinia coronata* Corda. var. *coronata*) have been reported in Alabama. Rust reduces yield, palatability and forage quality, and may cause stand thinning. The disease usually is worst under the warm, moist conditions of early spring, and normally disappears after late spring grazing. Alta and Kentucky 31 are resistant to some races of the disease-causing fungus.

Tall fescue is susceptible to two fungi (*Helminthosporium dictyoides* and *H. vagans*) that can cause severe seedling blight. Both fungi can be active at any time; however, *H. dictyoides* is most active in spring and fall, *H. vagans* in summer. Kenwell is resistant to both, while Alta and Kentucky 31 are susceptible to both.

Root rot in tall fescue (caused by *Rhizoctonia solani* Kuhn) can be a serious problem in stand establishment and a threat to stand longevity. The disease is worst in warm and humid weather; for example; during a wet spring.

A leaf-spot disease caused by a species of *Cercospora* has been found on tall fescue in Kentucky. Kentucky 31 appears to be more resistant than Alta.

Several kinds of nematodes prune the roots of tall fescue, reducing yield and thinning stands. Nematode problems are most prevalent in fescue grown in light-textured soils. There are no good nematode control measures.

Tall fescue is relatively free of insect pests. However, fall armyworms (*Spodoptera frugiperda*) have been seen feeding in tall fescue pastures in Mississippi in late summer and early fall.

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Bulletin 875

January 1979

Variety Evaluation of Winter Annual Forage Crops, 1976-77

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Bulletin 875

Variety Evaluation of Winter Annual Forage Crops, 1976-77

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Mississippi Agricultural and Forestry Experiment Station
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January 1979

Variety Evaluation of Winter Annual Forage Crops, 1976-77

Winter annual forages are grown widely in Mississippi and are important in both beef and dairy production programs. Ryegrass probably is the most widely used winter annual forage crop and may be grown alone or in mixtures with small grains. Earlier research has demonstrated that a mixture of small grain and ryegrass will provide earlier grazing than ryegrass alone, but ryegrass generally will give a longer grazing season than a small grain. Wheat and rye probably are more cold tolerant than ryegrass.

New improved and standard varieties of winter annual forage crops are evaluated in MAFES small plot trials each year. Seed for the 1976-77 trials were obtained from commercial seed companies and state universities and tested at a number of locations in Mississippi. We used a randomized complete block with three to five replications, depending on location. Plot size differed from one location to another, depending upon harvesting equipment available. The number of harvests during the season varied by location because of different planting dates and growing conditions.

Results

Yields of most winter annual forage crops were lower than normal in 1976-77. Date of planting was delayed at most locations, and the unusually cold fall and winter delayed growth until spring.

The number of ryegrass varieties evaluated ranged from five at Holly Springs to 51 at Mississippi State (Tables 1-6). Five varieties were grown at six locations, and yields averaged over the six locations ranged from 4224 pounds per acre for Tetrablend to 5195 pounds for North Mississippi Reseeding (Table 7). Yields of North Mississippi Reseeding were much higher than those of other varieties at the two northernmost locations but differed only slightly from those of other varieties at locations south of Mississippi State. Yields of all varieties at locations south of Mississippi State were lower than at Holly Springs and Mississippi State.

North Mississippi Reseeding is a strain selected from a pasture on the MAFES North Mississippi Branch at Holly Springs. Ryegrass on this pasture has been managed as a reseeding stand for 25 years.

Oats were evaluated at four locations (Tables 1 and 8-10), and the number of varieties in the trials ranged from only two at Holly Springs to 13 at Poplarville. Nine varieties were grown at three locations, and yields averaged over the three locations ranged from 2959 pounds per acre for Cortez to 4348 for Cumberland (Table 11). Yields increased progressively from the southernmost to the northernmost location.

Wheat was evaluated at three locations (Tables 1, 12 and 13), and the number of varieties in the trials ranged from five at Holly Springs to 21 at Poplarville. Twelve varieties were grown at two locations, and yields averaged over the two locations ranged from 2639 pounds per acre for Abe to 3481 for McNair 3001 (Table 14). Yields of all but one variety were higher at Newton than at Poplarville.

Ryes and triticales were evaluated at four locations (Tables 1 and 15-19). Four rye varieties and four triticales were grown at three locations. Yields of the rye varieties averaged over the three locations ranged from 4848 pounds per acre for Vitagraze to 5321 for Wintergrazer 70, and yields of the triticales averaged over the three locations ranged from 4218 pounds per acre for 6 TA 522 to 4707 for 6 TA 131 (Table 20). Yields of the four rye varieties and the four triticales evaluated at the three sites increased progressively from the southernmost to the northernmost location.

The superior cold tolerance of wheat and rye was evident from results of the trials at Holly Springs (Table 1).

Table 1. Dry matter yield and winter kill of winter annual forage crops, by species and variety, Holly Springs, Miss. 1976-77.

Species	Dry Matter Yield					
and	Harvest Date					Winter
Variety	Oct. 18	March 12	April 18	May 5	Total	Kill*
	lbs/acre					%
Ryegrass						
North MS Reseeding	1289	1382	4150	673	7494	0
Tetrablend	1586	618	3402	771	6377	4
Magnolia	995	455	3737	722	5909	28
Common	1646	393	3058	682	5779	27
Gulf	1628	260	3183	660	5731	55
Mean	1429	622	3506	702	6259	
Wheat						
Coker 74-27	1118	1599	4392		7109	0
Coker 68-15	1508	2168	2836		6512	0
Arthur 71	1112	1756	3323		6191	0
Coker 73-23	1005	1621	3336		5962	4
Coker 75-20	522	1285	2968		4775	26
Mean	1053	1686	3371		6110	
Oats						
Coker 227	1652	458	2672		4782	73
Coker 75-11	1670	129	2245		4044	76
Mean	1661	294	2458		4413	
Rye						
Vitagraze	1965	2611	2246		6822	0
Wintergrazer	1457	2538	2784		6779	0
Mean	1711	2574	2515		6800	
Triticale						
6 TA-131	1711	1111	4380		7202	0
LSD (.05)	190	315	337	NS	584	

Planted: Aug. 24, 1976
Fertilizer: 60-60-60 (N-P_2O_5-K_2O) lbs /acre at planting
60 lbs N Oct. 18
60 lbs N March 15

***Determined March 14, 1977**

Table 2. Dry matter yield of ryegrass grown for forage, by variety, Mississippi State, Miss., 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	March 16	April 26	May 30	Total
	------------------------------ lbs/acre ------------------------------			
Billion	1584	3901	1117	6602
Common	1609	3820	858	6287
Florida 76-B	2311	3610	594	6515
Florida Rust Res.	1553	4899	622	7074
Furore	963	3204	699	4866
Gulf	1685	4501	498	6684
Magnolia	1326	4159	549	6034
Meritra	1182	2862	1027	5071
Midmar	1176	3232	735	5143
MR-2	1439	3345	526	5310
MR-4	1453	3595	507	5555
MR-9	1377	4367	699	6443
MR-14	1155	4086	573	5814
MR-19	1574	3604	461	5639
MR-30	1640	4917	693	7250
MR-32	1345	3697	502	5544
MR-35	1813	3919	616	6348
Ninak	1472	3607	977	6056
North MS Reseeding	2080	5539	1241	8860
NK K5-98	955	3293	703	4951
NK K5-99	1149	3215	1000	5364
NK K5-100	1136	3317	708	5161
NK K5-101	1012	2904	731	4647
NK K5-102	1322	3113	857	5292
NK K5-103	1130	3986	1017	6133
NK K5-104	958	3726	1126	5810
Oregon 68-1	1133	3407	658	5198
Oregon 69-2	1325	3389	1170	5884
Oregon 69-3	1454	3233	697	5384
Oregon 69-4	1667	3863	761	6291
R. 0018	1353	3159	915	5427
R. 0028	1298	3656	987	5941
R. 0051	1555	3296	910	5761
State College 1	1308	3956	306	5570
State College 2	1063	3633	376	5072
State College 3	952	2862	233	4047
State College 4	1076	3461	210	4747
State College 5	1609	3707	398	5714
State College 7	1265	3622	429	5316
State College 8	1197	3410	367	4974
State College 9	1530	3925	299	5754
State College 11	1166	3254	259	4679
State College 12	1491	3534	426	5451
State College 13	1708	3296	363	5367
State College 14	1396	3978	348	5722
State College 67	1616	3716	687	6019
Stoneville 3	1215	4365	602	6182
Tetrablend	1041	3908	939	5888
Tetrone	1395	4059	1033	6487
Urbana	1308	3560	1103	5971
Vital	1156	3144	1087	5387
Mean	1366	3683	690	5739
LSD (.05)	653	1093	312	2028

Table 3. Dry matter yield of ryegrass grown for forage, by variety, Brooksville, Miss., 1976-77.

	Dry Matter Yield		
	Harvest Date		
Variety	April 12	May 30	Total
	-------------- lbs/acre --------------		
North MS Reseeding	1146	2356	3502
Magnolia	1326	1926	3252
Ninak	1468	1499	2967
Billion	1023	1293	2316
NK K5-104	1018	1079	2097
NK K5-102	1079	1273	2352
Gulf	1069	1691	2760
NK K5-99	1177	1613	2790
NK K5-101	1287	1612	2899
NK K5-98	1022	1665	2687
Tetrablend	1003	1375	2378
Common	766	2134	2900
Vital	1106	1355	2461
Tetrone	887	1123	2010
Urbana	1032	1434	2466
Furone	1036	1297	2333
NK K5-100	956	1595	2551
Mean	1082	1548	2631
LSD (.05)	NS	600	710

Planted: Oct. 15, 1976 25 lbs /acre
Fertilizer: 60-60-60- (N-P_2O_5-K_2O) lbs /acre at planting
60 lbs N March 17

Table 4. Dry matter yield of ryegrass grown for forage, by variety, Newton, Miss., 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	March 15	April 8	April 29	Total
	lbs/acre			
Magnolia	1726	1439	1337	4502
Tetrablend	1610	1617	1368	4595
North MS Reseeding	1656	1648	1392	4696
Gulf	1781	1524	1065	4370
Common	1890	1525	1407	4822
NK K5-98	1096	1338	1431	3865
NK K5-99	1602	1664	1260	4526
NK K5-100	1687	1478	1221	4386
NK K5-101	1703	1602	1213	4518
NK K5-102	1625	1556	1167	4348
NK K5-103	1618	1369	1229	4216
NK K5-104	1633	1509	1283	4425
Mean	1635	1552	1281	4438
LSD (.05)	NS	NS	107	323

Planted: Oct. 5, 1976
Fertilizer: 65-65-65 (N-P_2O_5-K_2O) lbs /acre at planting
45 lbs N December
45 lbs N March
45 lbs N April

Table 5. Dry matter yield of ryegrass grown for forage, by variety, Raymond, Miss., 1976-77.

	Dry Matter Yield		
	Harvest Date		
Variety	April 7	May 5	Total
	lbs/acre		
Magnolia	2172	958	3130
Tetrablend	2006	1456	3462
North MS Reseeding	2168	1500	3668
Gulf	2398	906	3304
Common	2232	1258	3490
NK K5-98	1850	992	2842
NK K5-99	1984	1358	3342
NK K5-100	1844	1306	3150
NK K5-101	1936	1434	3370
NK K5-102	2234	1316	3550
NK K5-103	2010	1362	3372
NK K5-104	1620	1586	3206
Mean	2038	1286	3324
LSD (.05)	272	360	364

Planted: Nov. 2, 1976
Fertilizer: 80-60-60- (N-P_2O_5-K_2O) lbs /acre at planting
80 lbs N Feb. 15

Table 6. Dry matter yield of ryegrass grown for forage, by variety, Poplarville, Miss. 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	Feb. 8	March 10	April 6	Total
	---------- lbs/acre ----------			
Magnolia	116	1365	1543	3024
Tetrablend	55	935	1653	2643
North MS Reseeding	34	1326	1589	2949
Gulf	100	1463	1837	3400
Common	37	1266	1461	2764
NK K5-98	38	932	1530	2500
NK K5-99	88	1168	1635	2891
NK K5-100	29	935	1713	2677
NK K5-101	25	670	1244	1939
NK K5-102	23	1055	1711	2789
NK K5-103	47	1184	1562	2793
NK K5-104	37	1037	1693	2767
Mean	52	1111	1598	2761
LSD (.01)	52	NS	NS	NS

Planted: Oct. 19, 1976
Fertilizer: 68-60-60 (N-P_2O_5-K_2O) lbs /acre at planting
68 lbs N Feb. 8

Table 7. Dry matter yield of the five ryegrass varieties grown for forage at six locations, by location and variety, Mississippi, 1976-77.

	Dry Matter Yield				
Location	Magnolia	Tetrablend	North MS Reseeding	Gulf	Common
	---------- lbs/acre ----------				
Holly Springs	5909	6377	7494	5731	5779
Mississippi State	6034	5888	8860	6684	6287
Brooksville	3252	2378	3502	2760	2900
Newton	4502	4595	4696	4370	4822
Raymond	3130	3462	3668	3304	3490
Poplarville	3025	2643	2949	3400	2764
Mean	4309	4224	5195	4375	4340

Table 8. Dry matter yield of oats grown for forage, by variety, Mississippi State, Miss., 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	Feb. 17	March 16	May 30	Total
	lbs/acre			
Coker 227	1164	2222	3424	6810
Coker 234	1423	1698	2747	5868
Coker 75-11	1964	1500	3227	6691
Coronado	1162	1389	2134	4685
Cortez	788	1047	1628	3463
Cumberland	1356	1964	3554	6874
Florida 501	1553	1228	2126	4907
TAM-O-301	837	1288	2225	4350
TAM-O-312	927	1311	1960	4198
Mean	1242	1516	2558	5316
LSD (.05)	473	348	614	910

Planted: Sept. 24, 1976

Fertilizer: 60-60-60 (N-P_2O_5-K_2O) lbs /acre at planting
60 lbs N Feb. 17

Table 9. Dry matter yield of oats grown for forage, by variety, Newton, Miss., 1976-77.

	Dry Matter Yield		
	Harvest Date		
Variety	March 17	April 15	Total
	lbs/acre		
Coker 227	2778	581	3359
Coker 234	2533	670	3203
Coker 75-11	2288	729	3017
Coronado	2298	621	2919
Cortez	2308	877	3185
Cumberland	2788	936	3724
Fla. 501	2355	837	3192
TAM-O-301	2374	985	3359
TAM-O-312	2473	946	3419
Mean	2466	798	3264
LSD (.05)	NS	234	NS

Planted: Oct. 5, 1976

Fertilizer: 65-65-65- (N-P_2O_5-K_2O) lbs /acre at planting
45 lbs N December
45 lbs N March
45 lbs N April

Table 10. Dry matter yield of oats grown for forage, by variety, Poplarville, Miss., 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	Feb. 8	March 10	April 6	Total
	lbs/acre			
Coker 76-14	111	844	820	1775
Coker 227	106	1371	1325	2802
Coker 234	106	1124	1086	2316
Coker 75-11	140	1200	1242	2582
Coker 76-19	202	1337	1006	2545
Coker 76-16	153	1602	1295	3050
Coker 76-18	246	1388	1336	2970
Coronado	53	941	921	1915
Cortez	62	898	1269	2229
Cumberland	19	1110	1316	2445
Fla. 501	126	1131	1047	2304
TAM-O-301	15	447	1134	1596
TAM-O-312	31	689	1101	1821
Mean	106	1083	1146	2335
LSD (.05)	121	552	NS	NS

Planted: Oct. 19, 1976
Fertilizer: 68-60-60 ($N\text{-}P_2O_5\text{-}K_2O$) lbs /acre at planting
68 lbs N Feb. 8

Table 11. Dry matter yield of the nine oat varieties grown for forage, at three locations, by variety and location, Mississippi, 1976-77.

	Dry Matter Yield			
Variety	Miss. State	Newton	Poplarville	Average
	lbs/acre			
Coker 227	6810	3359	2802	4324
Coker 234	5868	3203	2316	3796
Coker 75-11	6691	3017	2582	4097
Coronado	4685	2919	1915	3173
Cortez	3463	3185	2229	2959
Cumberland	6874	3724	2445	4348
Fla. 501	4907	3192	2304	3468
TAM-O-301	4350	3359	1596	3102
TAM-O-312	4198	3419	1821	3146
Mean	5316	3264	2223	3601

Table 12. Dry matter yield of wheat grown for forage, by variety, Newton, Miss., 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	Dec. 9	March 9	April 27	Total
	lbs/acre			
McNair 3001	340	2205	1862	4407
McNair 3069	770	924	1251	2945
Coker 68-15	520	2063	1090	3673
Coker 68-19	680	1819	1301	3800
Coker 74-27	360	1758	1241	3359
Coker 75-20	300	2042	1210	3552
Abe	280	1432	920	2632
Arthur 71	450	1849	1091	3390
Oasis	310	1624	1050	2984
Stoddard	300	1819	1131	3250
Doublecrop	290	2002	1261	3553
L 723	280	2246	1531	4057
L 724	360	2459	1280	4099
L 754	350	2012	1381	3743
Mean	399	1875	1257	3531
LSD (.05)	215	545	NS	773

Planted: Oct. 5, 1976
Fertilizer: 65-65-65 (N-P_2O_5-K_2O) lbs /acre at planting
45 lbs N December
45 lbs N March
45 lbs N April

Table 13. Dry matter yield of wheat grown for forage, by variety, Poplarville, Miss., 1976-77.

	Dry Matter Yield			
	Harvest Date			
Variety	Feb. 8	March 10	April 6	Total
	lbs/acre			
McNair 3001	350	1307	898	2555
McNair 3069	490	1157	794	2441
DeKalb H-55	237	1467	714	2418
DeKalb H-54	405	1453	871	2729
DeKalb H-60	91	1190	943	2224
DeKalb H-61	129	1849	1099	3077
DeKalb HG-22	68	1554	1093	2715
DeKalb HG-23	28	1407	1002	2437
Coker 68-15	320	1591	1256	3167
Coker 68-19	584	1329	597	2510
Coker 74-27	186	1572	1218	2976
Coker 75-24	645	1181	882	2708
Coker 75-27	393	1456	739	2588
Abe	67	1441	1137	2645
Arthur 71	265	1469	1142	2876
Oasis	127	1352	818	2297
Stoddard	90	1288	1262	2640
Doublecrop	69	1091	993	2153
L 723	482	1598	734	2814
L 724	334	1483	989	2806
L 754	639	1420	652	2711
Mean	285	1412	944	2641
LSD (.01)	227	NS	LSD (.05) 406	NS

Planted: Oct. 19, 1976

Fertilizer: 68-60-60 (N-P_2O_5-K_2O) lbs /acre at planting
68 lbs N Feb. 8

Table 14. Dry matter yield of the 12 wheat varieties grown for forage, at two locations, by variety and location, Mississippi, 1976-77.

Variety	Dry Matter Yield		
	Newton	Poplarville	Average
	lbs/acre		
McNair 3001	4407	2555	3481
McNair 3069	2945	2441	2693
Coker 68-15	3673	3167	3420
Coker 74-27	3359	2976	3168
Abe	2632	2645	2639
Arthur 71	3390	2876	3133
Oasis	2984	2297	2641
Stoddard	3250	2640	2945
Doublecrop	3553	2153	2853
L 723	4057	2814	3436
L 724	4099	2806	3453
L 754	3743	2711	3227
Mean	3508	2673	3091

Table 15. Dry matter yield of ryes and triticales grown for forage, by variety, Mississippi State, Miss., 1976-77.

Variety	Dry Matter Yield			
	Harvest Date			
	Feb. 17	March 23	May 23	Total
	lbs/acre			
Rye				
Wintergrazer A	3578	1884	1888	7350
Wintergrazer 70	3916	1799	2082	7797
Wintergrazer	3920	1953	1747	7620
Vitagraze	3913	1339	1259	6511
Mean	3832	1744	1744	7320
Triticale				
6 TA 131	1504	2291	2865	6660
6 TA 522	2045	1832	2038	5915
6 TA 876	1349	1961	3111	6421
Commercial Blend	1795	1924	2046	5765
Mean	1671	2002	2515	6188
Mean	2752	1873	2130	6754
LSD (.05)	946	410	436	875

Planted: Sept. 24, 1976
Fertilizer: 60-60-60 ($N-P_2O_5-K_2O$) lbs /acre at planting
60 lbs N Feb. 17

Table 16. Dry matter yield of ryes grown for forage, by variety, Poplarville, Miss., 1976-77.

Variety	Dry Matter Yield Harvest Date Feb. 8	March 10	April 6	Total
	lbs/acre			
Wintergrazer A	456	2115	966	3537
Wintergrazer 70	424	2190	965	3579
Wintergrazer	289	1913	1423	3625
Vitagraze	862	1952	762	3576
Mean	508	2042	1029	3579
LSD (.05)	569	NS	NS	NS

Planted: Oct. 19, 1976
Fertilizer: 68-60-60 (N-P_2O_5-K_2O) lbs /acre at planting
68 lbs N Feb. 8

Table 17. Dry matter yield of triticales grown for forage, by variety, Poplarville, Miss., 1976-77.

Variety	Dry Matter Yield Harvest Date Feb. 8	March 10	April 6	Total
	lbs/acre			
6 TA 131	19	1447	1604	3070
6 TA 522	2	679	1482	2161
6 TA 867	6	1084	1332	2422
Commercial Blend	135	1209	1257	2601
Mean	40	1105	1419	2564
LSD (.05)	41	NS	NS	NS

Planted: Oct. 19, 1976
Fertilizer: 68-60-60 (N-P_2O_5-K_2O) lbs /acre at planting
68 lbs N Feb. 8

Table 18. Dry matter yield of ryes grown for forage, by variety, Newton, Miss., 1976-77.

Variety	Dry Matter Yield Harvest Date Dec. 17	Feb. 25	March 15	April 14	Total
	lbs/acre				
Wintergrazer A	985	861	1893	1056	4795
Wintergrazer 70	822	751	1951	1062	4586
Wintergrazer	744	807	1797	842	4190
Vitagraze	960	719	1659	1119	4457
Mean	878	784	1825	1020	4507
LSD (.05)	NS	NS	NS	NS	NS

Planted: Oct. 5, 1976
Fertilizer: 65-65-65 (N-P_2O_5-K_2O) lbs /acre at planting
45 lbs N December
45 lbs N March
45 lbs N April

Table 19. Dry matter yield of triticales grown for forage, by variety, Newton, Miss., 1976-77.

Variety	Dry Matter Yield Harvested on Dec. 17	March 17	April 14	May 12	Total
	lbs/acre				
6 TA 131	429	1877	1306	778	4390
6 TA 522	327	1895	1577	778	4577
6 TA 876	171	1719	1625	866	4381
Commercial Blend	196	1992	1530	759	4477
Mean	281	1871	1510	795	4456
LSD (.05)	NS	NS	NS	NS	NS

Planted: Oct. 5, 1976

Fertilizer: 65-65-65 (N-P_2O_5-K_2O) lbs /acre at planting
45 lbs N December
45lbs N March
45 lbs N April

Table 20. Dry matter yield of the four rye varieties and four triticales grown for forage, at three locations, by variety and location, Mississippi, 1976-77.

Variety	Dry Matter Yield Newton	Poplarville	Miss. State	Average
	lbs/acre			
Rye				
Wintergrazer A	4795	3537	7350	5227
Wintergrazer 70	4586	3579	7797	5321
Wintergrazer	4190	3625	7620	5145
Vitagraze	4457	3576	6511	4848
Mean	4507	3580	7320	5135
Triticale				
6 TA 131	4390	3070	6660	4707
6 TA 522	4577	2161	5915	4218
6 TA 876	4381	2422	6421	4408
Commercial Blend	4477	2601	5765	4281
Mean	4456	2564	6190	4403

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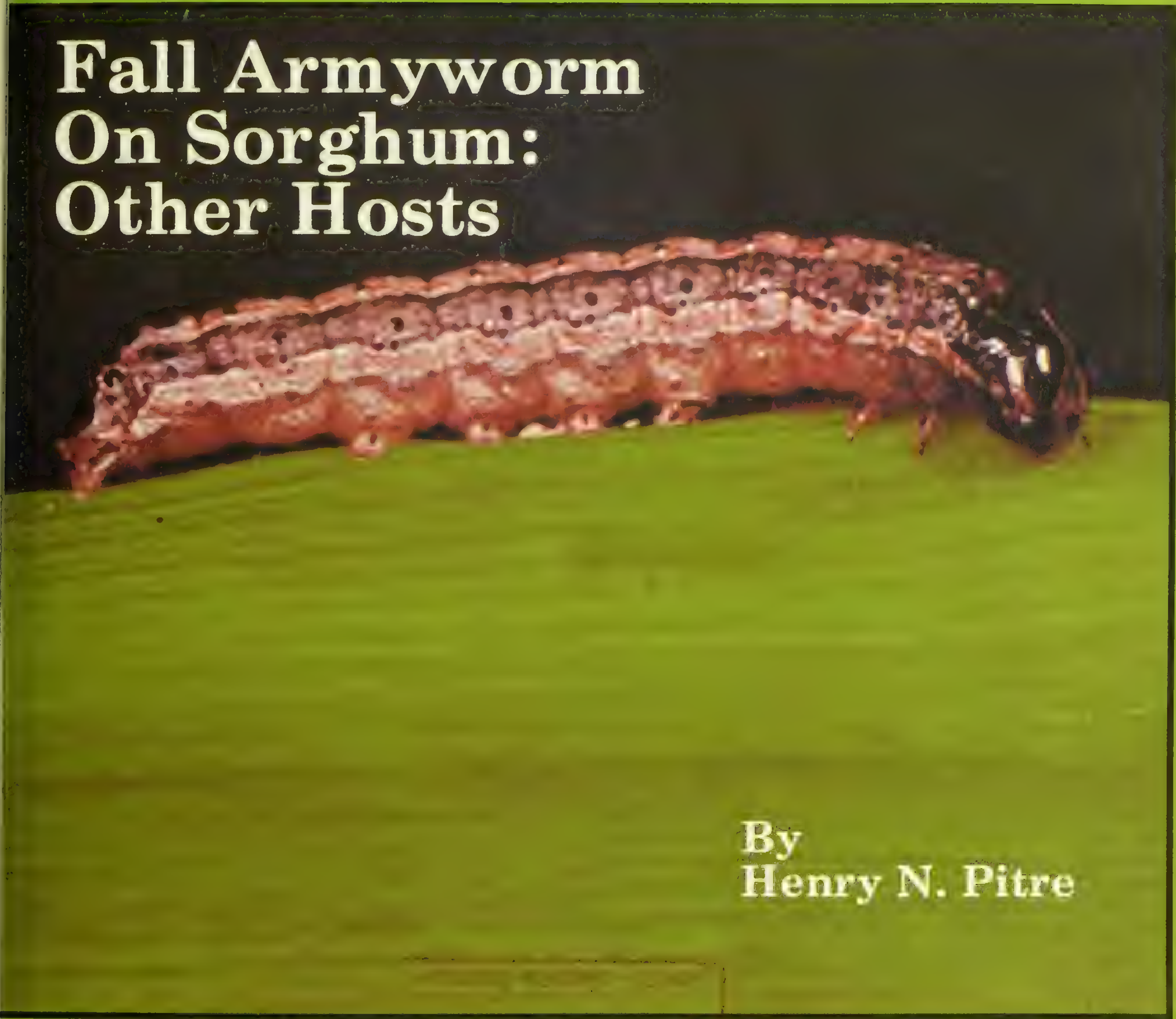
Fall Armyworm On Sorghum: Other Hosts



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Summary

Preferred pest management trategies for control of the fall rmyworm require minimum use of esticides to decrease the cost of roduction, minimize hazards of nvironmental contamination and rotect populations of natural nemies. Recommendations for ccomplishing this in sorghum are

(1) planting early to escape large ate season populations,

(2) planting, if available, a variety that possesses resistance,

(3) scouting the crop frequently for early signs of fall armyworm infestations (state and federal reports of moth catches indicating armyworm activity can be useful in determining when to begin a scouting program),

(4) applying biological controls,

(5) applying insecticides at minimum labeled rates in enough water to obtain complete coverage, including the area deep in the whorl if leaf damage and small larvae are observed on whorl-stage plants and larvae in the whorl average one per plant (ground applications of insecticides in 5 to 10 gallons of water per acre have provided the best control on whorl-stage sorghum), and

(6) examining fields at intervals after insecticide application to determine reinfestation.

Fall Armyworm On Sorghum: Other Hosts

The fall armyworm, *Spodoptera ugiperda* (J. E. Smith), is olyphagous and feeds on both ultivated and uncultivated plants. he adult is an ash-gray moth Figure 1). The front wings are mottled with white or gray spots near the tips, and the rear wings have a light-brown edge. Adults live two to three weeks.

Females lay eggs indiscriminately on plant foliage in masses of about 50 to several hundred deposited in layers. Eggs are covered with a grayish fuzz (scales from the female moth) and hatch in two to four days depending upon temperature.

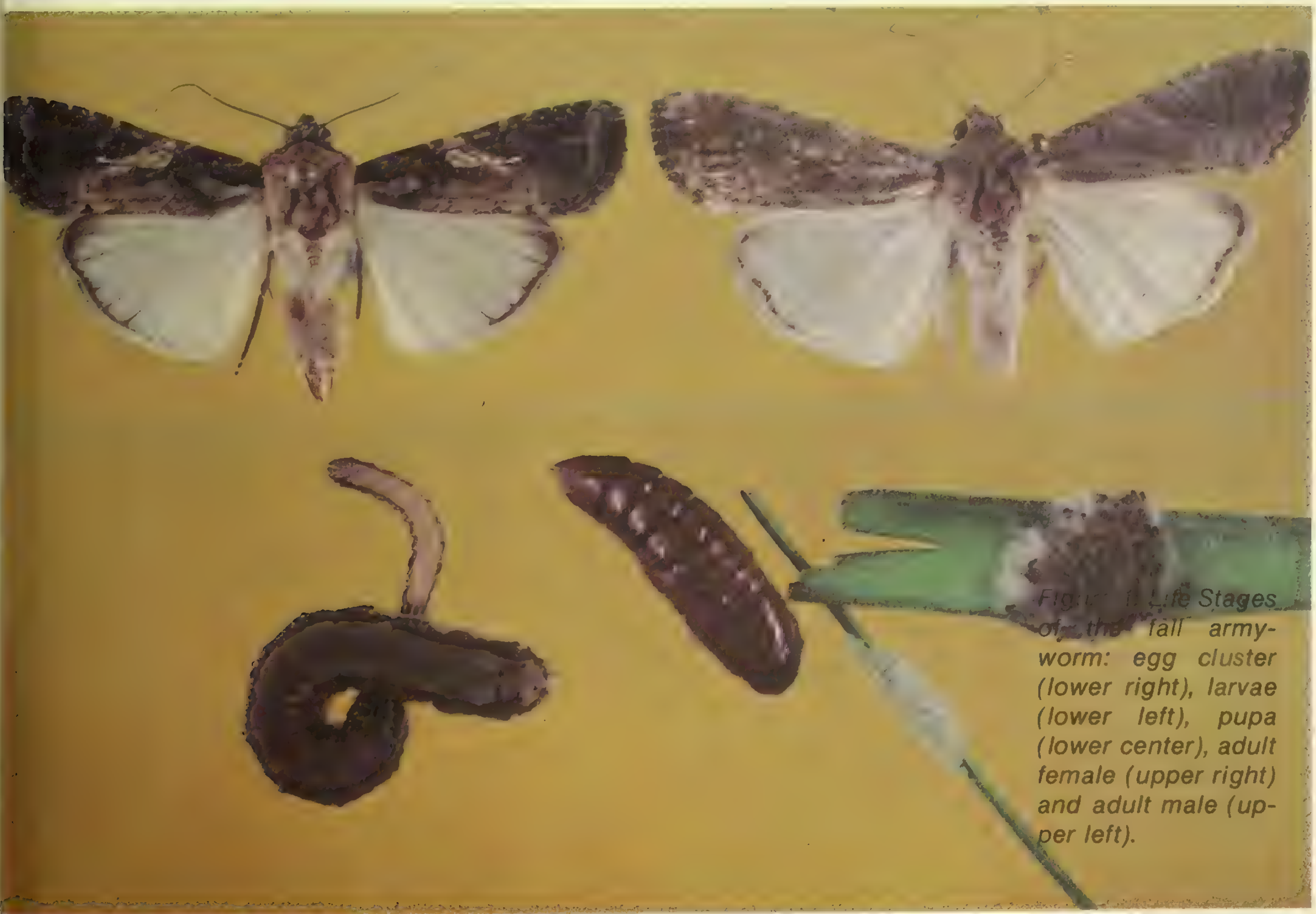

Figure 1. Life Stages of the fall armyworm: egg cluster (lower right), larvae (lower left), pupa (lower center), adult female (upper right) and adult male (upper left).

The young larva is whitish at first and has a black head. The body becomes dark with stripes as the larva grows. The fully grown larva may be 1.5 inches long and may be light green to almost black with stripes along the length of the body. The head is dark and shiny and is marked with a light-colored, inverted Y. Color patterns are highly variable within species groups (Levy and Habeck 1976).

Fall armyworm larvae feed in colonies for a short time immediately after hatching, but the small larvae soon disperse to other parts of the initial host plant, or to other plants in the area. Newly hatched larvae move upward on the leaves and usually are found on upper plant parts where they feed on the outer layer of leaf tissue (Figure 2). Young larvae often produce silk-like threads and drop by these to other plant parts. Many that drop to the ground are killed by predators or become infected by soil-inhabiting disease organisms.

Older fall armyworm larvae prefer to feed deep in the whorl of a plant. There they are protected from natural enemies, and insecticides are less effective than when applied to larvae feeding on the surface of upper leaves. However, the plant bud is damaged only occasionally by larvae feeding in the whorl.

Fall armyworms are cannabilistic and usually only one late instar larva will survive in the whorl of a plant. However, small larvae from a different egg hatch may be on the upper leaves while a large larva is in the whorl. Th small larvae usually will dispe to surrounding plants, or be ki if they penetrate to where surviving larger larva is feedi

Development of the fall myworm from the egg to a mat larva requires about two to th weeks. The mature larva burro 1.0 to 2.0 inches into the soil develops into a reddish-bro pupa that later becomes alm black. The pupal stage may las to 14 days.

The pupal stage is considere be the overwintering stage in United States. The fall armyw apparently cannot overwi successfully in North Amer except in southern Florida Texas (Luginbill 1928).

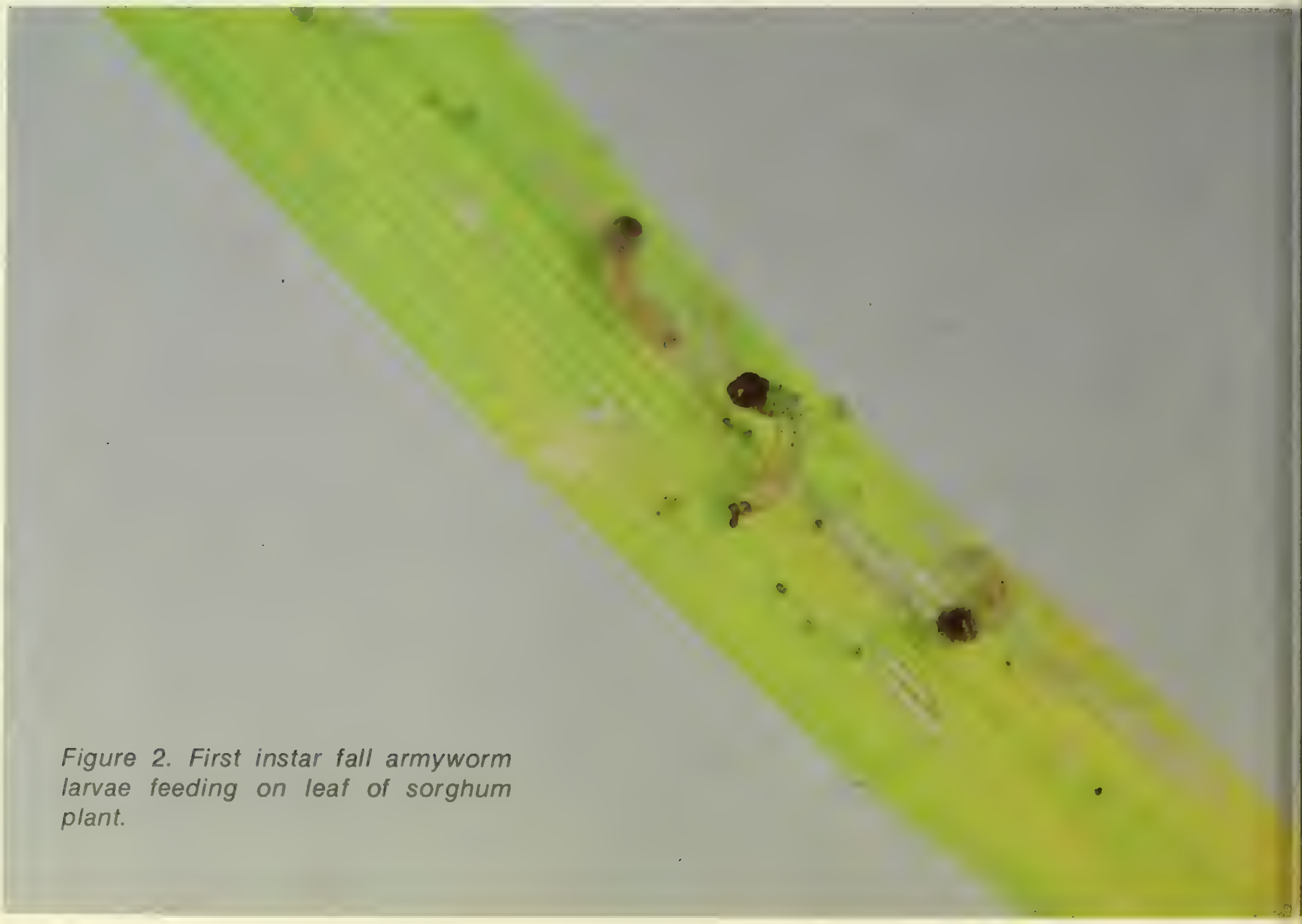

Figure 2. First instar fall armyworm larvae feeding on leaf of sorghum plant.

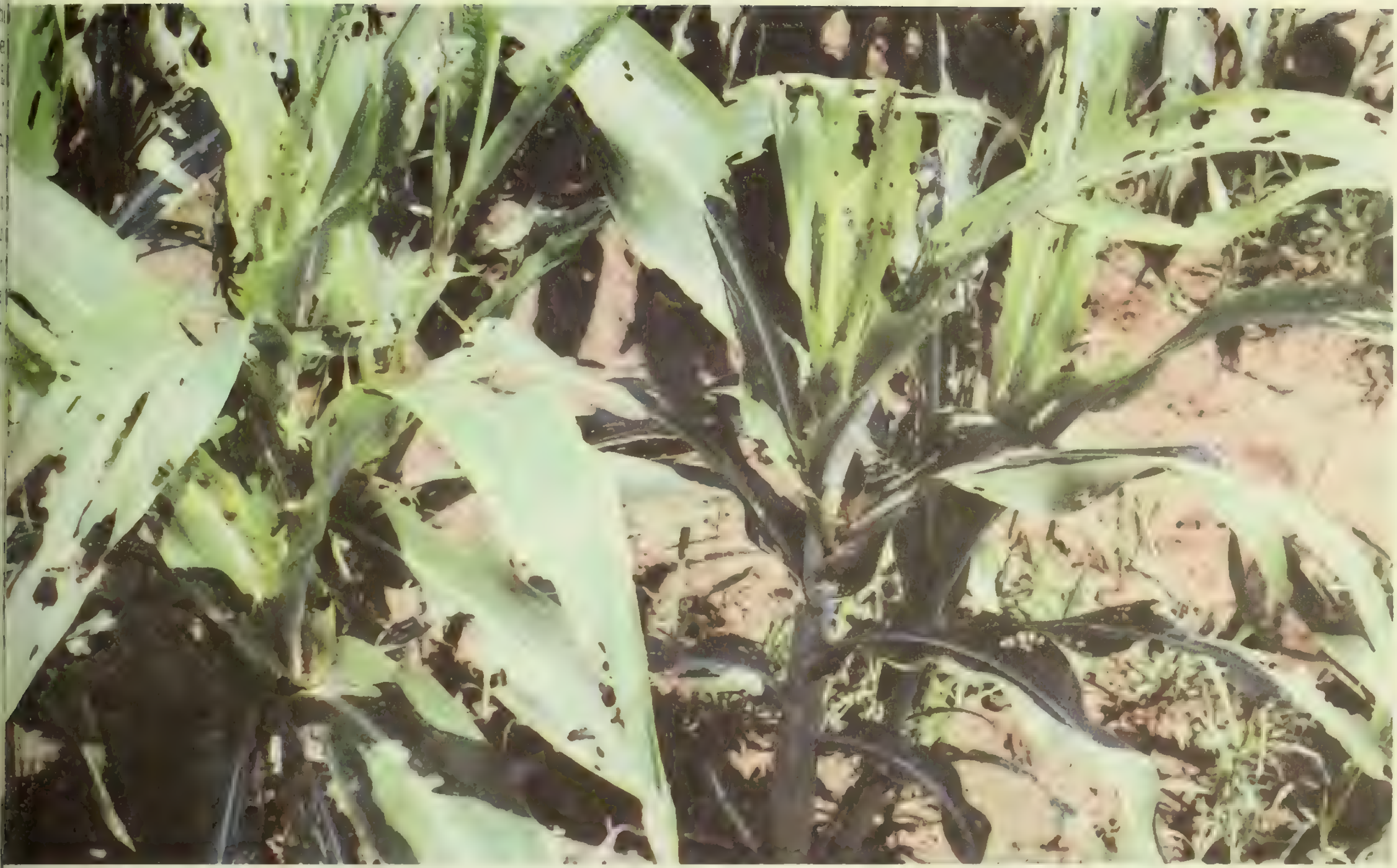

Figure 3. Sorghum plant damaged by fall armyworm larvae.

Economic Significance of the Fall Armyworm

Agricultural crops attacked by the fall armyworm include corn, sorghum, peanuts, sugarcane, tobacco, cotton and soybeans. Cotton is seldom damaged; however, the fall armyworm caused serious injury to this crop throughout the southeastern United States in 1977. Populations were below normal in 1978 and damage to crops was less than in 1977.

The 36,200 acres of sorghum harvested for grain and the 45,000 acres harvested for silage in Mississippi in 1977 are consistent with the declining trend in sorghum production in the state. The decline in sorghum production in Mississippi and other southeastern states where sorghum is grown can be attributed in great part to the relatively favorable prices for soybeans that have caused a substitution of soybeans for sorghum on some soil types. However, the national average grain yield of sorghum in 1977 was 2,725 lbs per acre compared with 2,074 lbs per acre in Mississippi, and the relatively low yields have contributed to the declining sorghum acreage in the state.

Diseases and insects have contributed to the declining yields, and the fall armyworm causes economic injury to the sorghum crop in some years. The armyworm must be recognized as a serious pest in Mississippi and other southeastern states because of consistently high populations in recent years.

Sorghum and other grain crops (e.g., corn, Navas 1974) can tolerate heavy feeding by the fall armyworm and similar foliage feeders. Sorghum plants are more attractive for egg laying by the armyworm moths during the first few weeks of growth than in later growth stages, and younger plant tissues appear to be most suitable as feeding sites for small larvae. Stand losses may result from heavy feeding of fall armyworms on young seedlings, and large infestations of the armyworm can result in considerable damage that causes plants to appear ragged (Figure 3).

Fall armyworms in whorl stage sorghum have been reported to be responsible for yield reductions of up to 20%. The lower yields appeared to be the result of smaller kernels, rather than fewer kernels per grain head (Henderson et al. 1966). Infestations of larger numbers of worms result in retarded plant growth. Immature heads that have not emerged from the boot may not be seriously damaged, but worms move up and feed on developing seed in the grain heads.

The purpose of this publication is to present results of research designed to develop an integrated pest management program for control of the fall armyworm on grain sorghum. Obviously, the first step in any successful pest management program is identification of the problem.

Identifying the Fall Armyworm Problem

Examination of plants should begin as soon as possible after the expected date of moth arrival in an area. Detection of egg masses is not difficult but takes time. A more practical approach is to look for feeding damage and for young larvae on the upper leaves of plants. Damage by young larvae can be detected by looking for streaks left by removal of the outer layer of leaf tissue (Figure 4). Examinations of the whole plant are required to determine the level of infestation of larvae in the whorls. This is accomplished by pulling a representative sample of plants and examining these to determine the percentage of plants infested with larvae, and the stage of development of the larvae.

Management of the pest is not as difficult when larvae are detected early as when detected at later stages after having caused considerable damage deep in the whorls. Pesticides are more effective when applied at minimum effective rates against young larvae than at the higher rates frequently required when larvae are large.

Recommendations for timing of pesticide applications in the absence of well-defined economic or treatment thresholds on whorl-stage sorghum are "control is needed when you find an average of one worm or more per plant . . . apply the insecticide when you find worms in the sorghum head."[1]

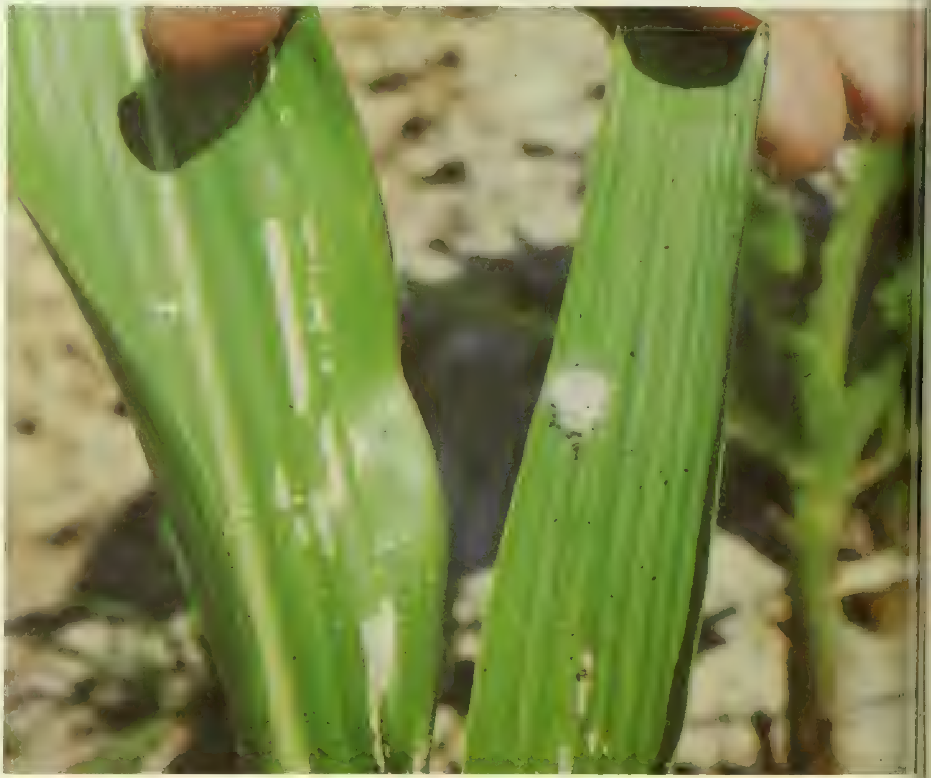

Figure 4. Damage to sorghum leaf by early instar fall armyworm larvae

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[1] *Mississippi Cooperative Extension Service Information Sheet 914. Instructions for producers interested i timing of insecticide applications on small grains are "look for very small worms around the base of plants o spring crops (March and April). Apply insecticides when 5-7 small worms are found per square foot. On fa planting, apply insecticide when you first notice ragging of leaves."*

Managing for Control of Armyworms on Sorghum

Current insect pest management concepts involve one or more practical methods for suppressing pest populations below levels that will cause economic injury to the crop. These include ecological, cultural, biological and chemical control.

Non-chemical methods for control of specific pests are available, but producers continue to rely heavily, or almost entirely in some areas, on insecticides for control of economic pests. The trend, however, is a movement away from total reliance on insecticides, by optimizing use of other strategies in combination with insecticides. For example, insecticides often are applied only after examination of the crop has revealed that pests are present at damaging levels. This procedure maximizes pest control, with minimum harm to the environment and natural enemies of economic pests. However, managing pests in diversified agroecosystems cannot be accomplished satisfactorily without the use of strategies other than observing to determine if and when insecticides are needed.

Cultural Practices

Large populations of fall armyworms in areas where they originate or in areas into which they migrate may be associated closely with cultural practices that encourage the increase of populations to damaging levels. Planting crops at the optimum time increases the probability of higher yields and minimizes the likelihood of insect populations reaching economic threshold levels. Sorghum planted in Mississippi from April 20 to May 20 usually produces higher yields than when planted at later dates, because of better germination and better growth of seedlings. Also, sorghum planted early may escape large fall armyworm population build-ups, or crop damage may be only moderate before the pest reaches peak numbers later in the year. Sorghum planted early (mid-April in the south, early May in the north) in Mississippi will escape serious fall armyworm damage, and the need for applying insecticides will be reduced or possibly eliminated.[2]

Resistant Varieties

Fall armyworm resistance in the form of antibiosis has been reported in pearl millet, *Pennisetum typhoides* (Burn.) Staph and C. E. Hubb (Leuck 1970). The major effect is suppression of the worm population resulting from reduced emergence of adult moths. McMillan and Starks (1966) reported that fall armyworm damage to sorghum differed significantly by variety.

Crop quality is improved and production costs are reduced when varieties resistant to insects are grown. Varieties with high levels of resistance are more effective for control of insects but are not always necessary, because varieties with low levels of resistance can be grown successfully with proper timing of insecticide applications. Yields are considerably higher if insecticides are applied early enough to permit plants to recover from worm damage than if application is delayed until the developing seed heads are damaged.

Fertilization and Mineral Nutrient Content of Soils

Fertilization contributes importantly to production of the lush, dark green sorghum vegetation preferred by the fall armyworm moth. Consequently, producers who fertilize at recommended or higher rates need to examine their fields carefully for evidence of early build-ups of fall armyworm populations.

The relationship of mineral nutrient content of soils to host plant preference of insects is not well understood. However, it appears that some minerals increase the attractiveness of plants to the fall armyworm moth, resulting in an increase in numbers of eggs laid.

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[2] *Pitre, H. N. (unpublished).*

Some compounds sprayed on plants have suppressed natural populations of the fall armyworm, by deterring feeding (Leuck et al. 1974). This suggests that foliar sprays of inorganic compounds (e.g., cupric sulfate and zinc sulfate) may be useful as deterrents to worm feeding and might be used in pest management programs to replace or supplement some pesticides.

Natural Enemies

The fall armyworm is exposed throughout its life cycle to disease organisms, parasites and predators (Luginbill 1928). When other control measures are not employed, populations of fall armyworms can develop to high levels if these natural enemies are absent or present in only limited numbers.

A nuclear polyhedrosis virus (Figure 5) and a fungus appear to be limiting to the development of fall armyworm populations in Mississippi during late season. All worms in a large population may be infected with the virus and/or fungus, resulting in an extremely small subsequent population.

Biological controls (e.g., nuclear polyhedrosis virus) applied to whorl-stage sorghum plants can be effective in control of young larvae, preventing damage to the grain head. Young larvae on the upper leaves are exposed and generally more susceptible; older larvae are less susceptible (Young and Hamm 1966).

Egg and larval parasites are potentially useful in managing fall armyworm populations in the field. However, the role of parasites and predators has not been defined.

Dry weather appears to be favorable for the fall armyworm but detrimental to many of its natural enemies (Carruth 1940).

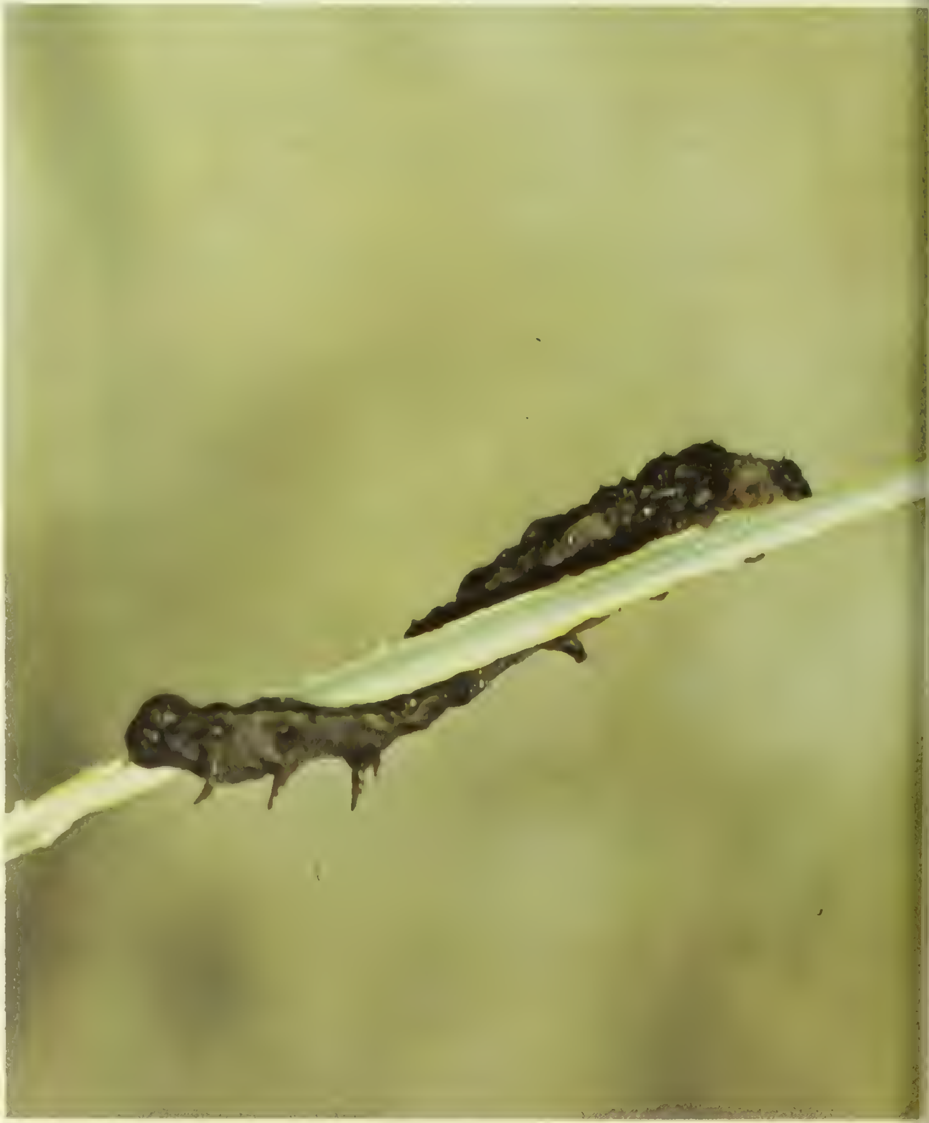

Figure 5. Fall armyworm larvae killed by virus.

Chemical Control

Control of the fall armyworm with insecticides has been considered relatively easy in the past. Nevertheless, producers frequently make more than one insecticide application.

Application of a recommended insecticide at labeled rates often is not sufficient to provide significant

Insecticide Guidelines and Restrictions
(Mississippi)

	Rate	Grazing Limitations
	(Lbs/acre)	(Days)
Sorghum, Corn, Small Grains		
carbaryl (Sevin®)	1.5-2.0	0
malathion*	1.25	7
methyl parathion**	0.75	15
toxaphene***	2.00	28
trichlorfon (Dylox®)**	0.5-1.0	21
Pasture Grasses		
carbaryl	1.50	0
ethyl parathion	0.75	15
malathion*	1.25	7
methyl parathion	0.75	15
trichlorfon	0.5-1.0	0

***No limitations on hay**

****Will burn foliage of some sorghum varieties and sorghum-sudan hybrids**

*****One application after heads are formed; not to be used on crops for silage or forage, for dairy animals or animals for slaughter; only cleared on crops for grain.**

control of the fall armyworm on sorghum and other grain crops, because the growth structure of plants and feeding behavior of the larvae often enable the insect to escape from the insecticide. Effectiveness of an insecticide application often can be related directly to the method of application and the amount of water used. This is particularly true for sorghum in the mid- to late-whorl stage, because the insecticide will not reach larvae deep in the whorl if enough water is not used.

Lannate,® toxaphene, diazion and Sevin® applied at labeled rates in 10 gallons of water per acre to 16-inch tall sorghum plants in Mississippi in 1976 effectively reduced populations of fall armyworm larvae after 24 hours (Table 1). Lannate and toxaphene applied at labeled rates in 10 gallons of water per acre to small (16-inch tall) and large (34-inch tall) whorl-stage sorghum plants in 1977 were effective after 24 hours, but Sevin at labeled rates in the same amount of water was not effective (Table 2). Lannate and toxaphene remained effective through day seven. Plant damage was about equal for all treatment plots 17 days after one insecticide application.

Pesticides applied with ground equipment usually have been more effective against fall armyworm larvae than when applied by air. The small amounts (2-3 gallons per acre) of water applied by air are not sufficient for adequate plant coverage; whereas, larger amounts (10-50 gallons per acre) applied with ground equipment have reduced infestations on whorl-stage sorghum plants.

Lorsban® applied at labeled rates in 5-10 gallons of water per acre to 21-inch tall whorl-stage sorghum

Table 1. Control of fall armyworm larvae with insecticides applied to 16-inch tall whorl-stage sorghum, by treatment, Mississippi, 1976.

Treatment[1]			Infested plants[2]	
Material	Formulation	Rate	Day 1	Day 7
		Lbs/A	--------%--------	
Lannate	1.8 EC	0.25	4 a[3]	10 a
Diazinon	4 EC	1.00	16 c	10 a
Sevin	70 S	2.00	13 bc	15 ab
Toxaphene	6 EC	2.00	8 ab	20 b
Untreated	---	---	33 d	20 b

[1] Insecticides applied on 8/13/76 in 10 gallons of water per acre, using a hand-held, compressed air sprayer at 30 psi.

[2] Days after application: Day 1 (8/14) Day 7 (8/20).

[3] Means followed by the same letter do not differ ($P < .05$) as determined by Duncan's Multiple Range Test.

Table 2. Control of fall armyworm larvae with insecticides applied to 16-inch and 34-inch tall whorl-stage sorghum, by treatment, Mississippi, 1977.

	Treatment[1]		Larvae count on				
			Day 1		Day 7		Damage
Material	Formulation	Rate (lb/A)	16-inch[2]	34-inch[3]	16-inch[2]	34-inch[3]	rating[4]
			Number/10 Plants				
Lannate	1.8 EC	0.25	0.0 a[5]	0.5 a	0.1 a	0.4 ab	5
Lannate	1.8 EC	0.50	0.3 a	0.4 a	0.1 a	0.3 a	5
Sevin	80% S	1.00	3.7 c	1.1 b	0.2 a	1.2 d	6
Sevin	80% S	1.50	3.9 c	1.1 b	0.2 a	1.0 cd	6
Sevin	80% S	1.75	3.1 c	1.3 b	0.2 a	0.8 bcd	6
Sevin	80% S	2.00	1.4 b	1.3 b	0.2 a	0.9 cd	6
Toxaphene	6 EC	1.50	0.6 a	1.1 b	0.1 a	0.4 ab	6
Toxaphene	6 EC	2.00	0.5 a	0.6 ab	0.1 a	0.4 ab	6
Untreated	---	---	1.8 b	1.1 b	0.3 a	0.7 bc	6

[1] Insecticides applied on 8/2/77 in 10 gallons of water per acre, using a hand-held, compressed air sprayer at 30 psi.

[2] Avg. ht. at application = 16 inches.

[3] Avg. ht. at application = 34 inches.

[4] Rating 1 = no damage; 6 = severe damage (17 days after insecticide application).

[5] Means followed by the same letter do not differ (P < .05) as determined by Duncan's Multiple Range Test.

in Mississippi in 1977 was more effective through day seven than toxaphene applied at labeled rates in the same amount of water. Toxaphene also was generally less effective than Lorsban after 24 hours (Table 3). Increasing the volume of water from 5 to 10 gallons per acre did not change effectiveness of Lorsban; whereas the effectiveness of toxaphene was greater when applied in 10 gallons of water per acre. Toxaphene at 2. lbs per acre in 5 gallons of wate was as effective as at the 1.0 lb pe acre rate in 10 gallons of water Toxaphene at 1.0 lbs per acre in 1 gallons of water was as effective a

Table 3. Control of fall armyworm larvae with insecticides applied to 21-inch tall whorl-stage sorghum, by treatment, Mississippi, 1977.

	Treatment[1]			Infested plants[2]		
Material	Formulation	Rate	Water	Day 1	Day 2	Day 7
		Lbs/A	Gals/A	%		
Lorsban	4 EC	0.50	10	8 ab[3]	14 bc	7 a
Lorsban	4 EC	1.00	5	4 a	7 a	27 bc
Lorsban	4 EC	1.00	10	8 ab	6 a	22 b
Toxaphene	6 EC	1.00	5	30 d	21 d	36 de
Toxaphene	6 EC	1.00	10	14 c	23 d	41 ef
Toxaphene	6 EC	2.00	5	12 bc	19 cd	32 cd
Toxaphene	6 EC	2.00	10	16 c	13 b	45 f
Untreated	---	---	---	40 e	18 bcd	33 cd

[1] Insecticide applied on 8/20/77 using a hand-held, compressed air sprayer at 30 psi.

[2] Days after application: Day 1 (8/21), Day 2 (8/22), Day 7 (8/27).

[3] Means followed by the same letter do not differ (P < .05) as determined by Duncan's Multiple Range Test.

at the 2.0 lbs per acre rate in 10 gallons of water. Results of the trial indicate that management of the fall armyworm with insecticides can be accomplished with minimum rates of the selected material applied in 5 to 10 gallons of water per acre.

Distribution of the Fall Armyworm

Fall armyworms disperse and breed throughout the United States (Luginbill 1928). The pest is spectacular because of the apparent sudden appearance of larvae in extremely large numbers and because of excessive feeding damage by the larvae.

Distribution of the fall armyworm is limited to North, Central and South America and the West Indies. It is well known in the United States but has been recognized as an annual pest on many crops in the southeastern United States only in recent years. Previous occurrence of the pest was considered to be cyclic, and economically damaging numbers were reached only occasionally.

Migration of the Fall Armyworm

Occurrence of annual migration by the fall armyworm in North America is generally accepted. Moths may move annually into most of the southern United States from overwintering further south; e.g., south Florida, Mexico and South America. The pest does not overwinter in the northern United States, and populations that develop there probably arise from moths migrating from states in the south (Vickery 1929).

The sudden appearance of the fall armyworm in late season (early September) as far north as Sault Ste. Marie and surrounding areas in Canada is suggestive of long-range migration (Rose 1975). This migration has been found to be associated with large populations of fall armyworms in north Mississippi; i.e., moth flights originating in North Mississippi were moved north on convection winds.

Seasonal Populations of Fall Armyworms

Normally there is only one generation of the fall armyworm in the northern United States. However, there are as many as six generations in the Gulf states. The sudden disappearance of populations indicates the closeness of ages within generations and emphazises the distinctness of generations. Therefore, it is possible to distinguish one generation from another in field populations of the fall armyworm.

Fall armyworm generations also can be distinguished in most years, using moth collections as a basis for delineation. Peak catches of moths have been recorded in different months of the past five to seven years, but the general trend is for populations to increase during June and July and peak in July and/or August. However, moth populations do not always reach a single peak and then decline but may, in any one year, reach about equally high numbers in two or more months.

Flights of fall armyworm moths into Mississippi during June and/or July have been reported consistently. Records of these flights are consistent with the literature on proposed migration of the pest into the Gulf states and are substantiated by the appearance of larvae at successively later dates from south to north. A reasonable assumption is that numbers of larvae on susceptible hosts in an area increase, in the absence of regulating factors, as

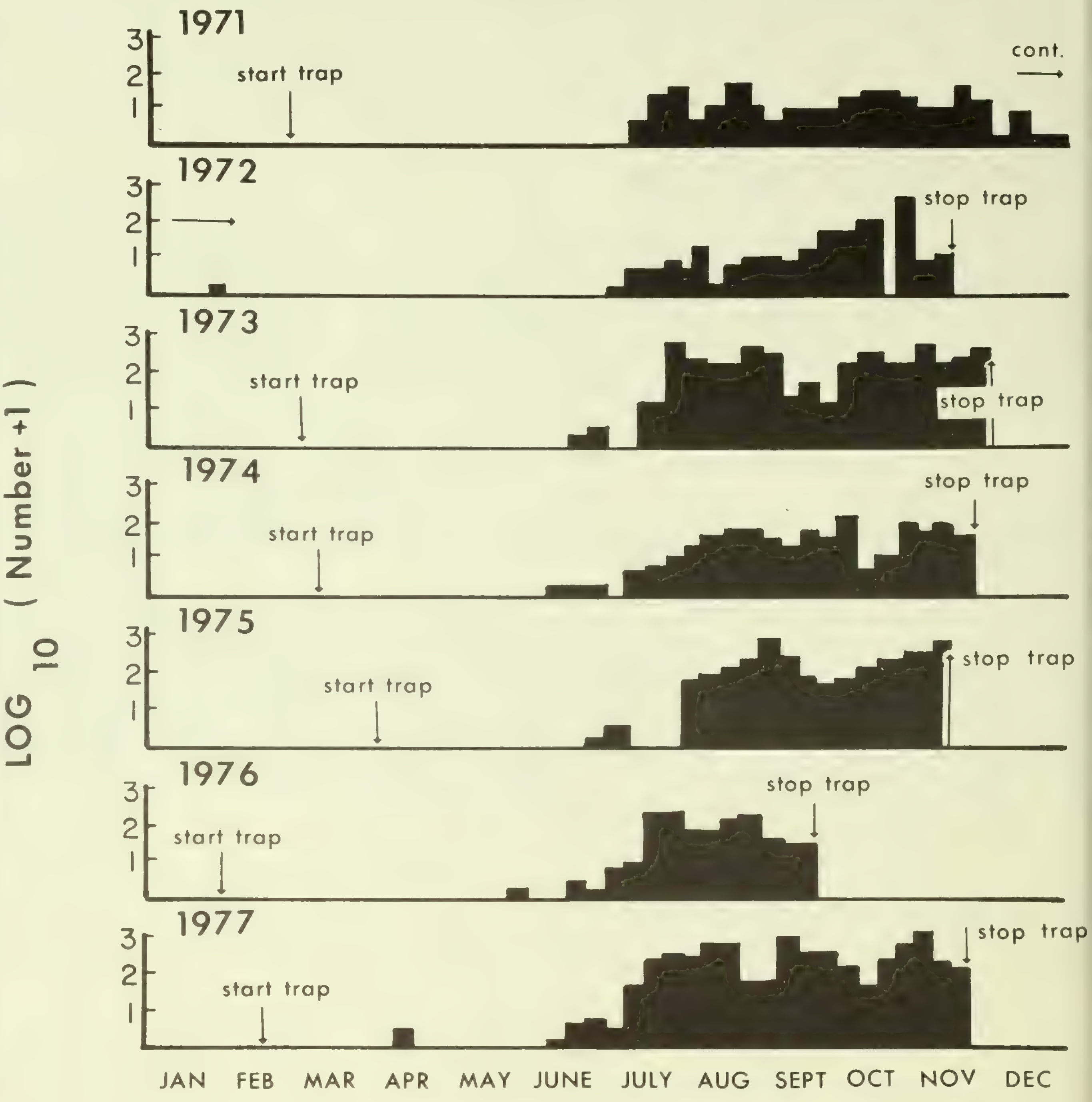

Figure 6. Fall armyworm light trap catches. Stoneville, Miss. 1971 - 77.

T.R. Pfrimmer U.S.D.A., B.I.C.L., Stoneville, MS.

moth populations increase in the area. Populations of fall armyworm larvae in south Mississippi normally reach damaging levels earlier than in central and north Mississippi.

Populations of fall armyworm larvae may not always parallel populations of adult moths. Natural enemies and diseases play an important role in suppressing larval populations, and a favorable environment for these biological control agents can result in the natural decline of the pest. The high infestations of larvae recorded in Mississippi during August and September in 1977 showed a sharp decline during October, principally because of diseases.

Unusually early arrival of fall armyworm moths can be expected to lead to early establishment of larval populations that year, giving the pest the potential of reaching higher populations earlier than if moths arrive later in the growing season. Several moths were collected at Stoneville, Miss. in late January 1972 but not again until early July. The few moths collected in January may have represented early migrants from areas south of Mississippi, and moths collected that early would not be expected to survive in most years because of low temperatures.

The earliest detection of fall armyworm moths at Stoneville in the last five years was in 1977, when moths were taken in light traps during the first week of April (Figure 6). Larval populations in Mississippi were established early that year, the population reached high levels earlier than in previous years when the first moths arrived later, and populations remained at damaging levels longer, with peak moth activity recorded in November.

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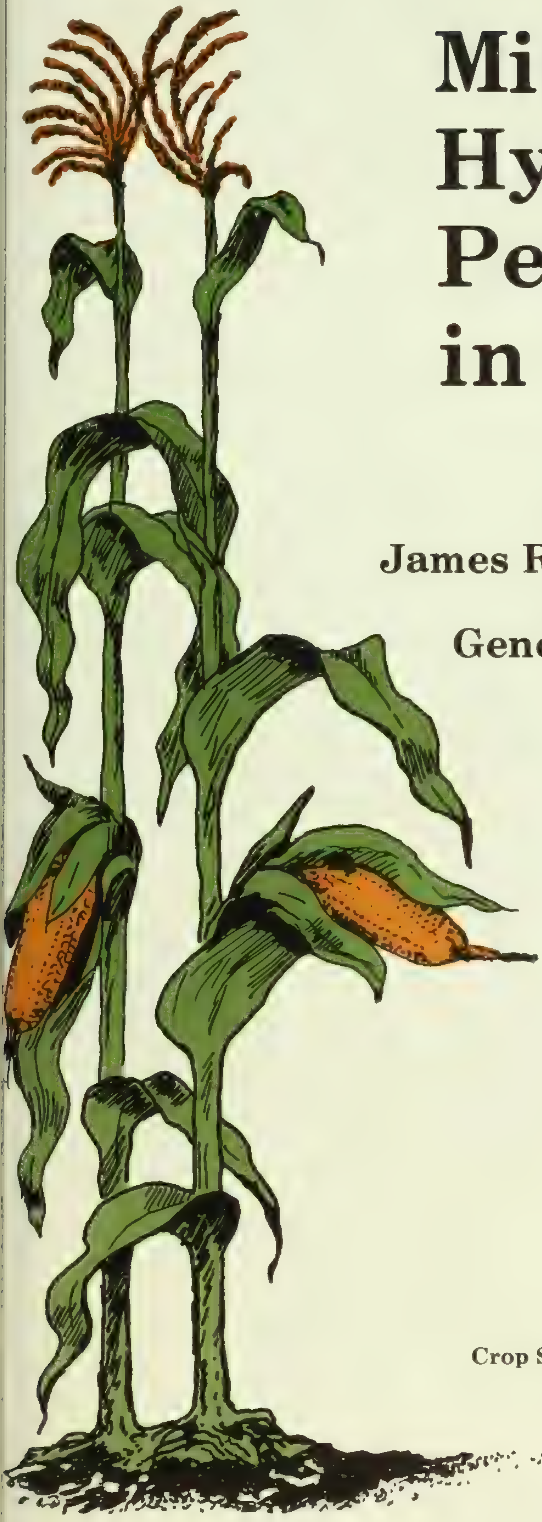
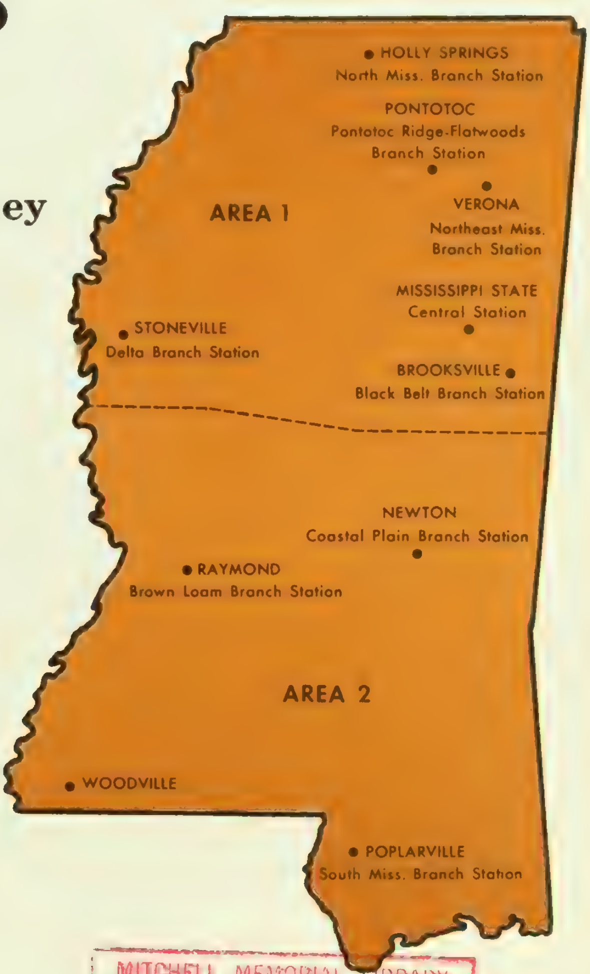
Mississippi Hybrid Corn Performance Trials in 1978



By
James R. McCluskey
and
Gene E. Scott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PONTOTOC
Pontotoc Ridge-Flatwoods Branch Station
AREA 1
VERONA
Northeast Miss. Branch Station
MISSISSIPPI STATE
Central Station
STONEVILLE
Delta Branch Station
BROOKSVILLE
Black Belt Branch Station
NEWTON
Coastal Plain Branch Station
RAYMOND
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Bulletin 877

Mississippi Hybrid Corn Performance Trials in 1978

by

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The Delta States Area
Crop Science and Engineering Research Laboratory
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Mississippi State, MS 39762

in cooperation with

Mississippi Agricultural and Forestry Experiment Station
Mississippi State University

January 1979

The following cooperated with the authors in conducting these test:

B. L. Arnold, Superintendent, North Mississippi Branch Station, Holly Springs

F. T. Withers, Jr., Superintendent, Pontotoc Ridge-Flatwoods Branch Experiment Station, Pontotoc

Normie Buehring, Agronomist, Northeast Mississippi Branch Station, Verona

Theodore C. Miller, Agronomist, Delta Branch Experiment Station, Stoneville

Robert E. Coats, Superintendent, Black Belt Branch Station, Brooksville

J. W. McMillan, Agronomist, Coastal Plain Branch Station, Newton

Ned C. Edwards, Agronomist, Brown Loam Branch Station, Raymond

Carl Hovermale, Agronomist, South Mississippi Branch Station, Poplarville

The test reported in Wilkinson County was on a private farm through the cooperation of T. O. Whitaker, RFD 4, Woodville, and John Dale, County Agent.

Mississippi Hybrid Corn Performance Trials in 1978

Trials are conducted annually in ssissippi to provide farmers, edsmen, county agents and her interested persons with information on the performance of mmercially available corn brids. Results of the trials are ovided for use by corn producers selecting hybrids suited to their ea. New hybrids may be comred with familiar hybrids and th check hybrids (Dixie 55 and ss. 6131), which are included in tests. Seed of Dixie 55 may or ay not be commercially ailable. Seed of Miss. 6131 are t commercially available.

Corn hybrids respond differently variations in environment, and a ven hybrid is not always the best under all conditions. Therefore, it is suggested that corn producers grow two or more good hybrids each year. This practice also reduces the chances for spread of a disease or insect infestation through the total corn acreage.

The yield of harvestable, good-quality grain (or silage) determines the desirability of corn hybrids. However, attributes other than yield may be extremely important in some instances. For example, resistance to a particular disease should be the prime consideration in areas where the disease occurs. That is, hybrids selected should be from those known to have resistance to diseases found in a geographic area.

All producers and/or distributors of seed corn are eligible to enter hybrids in these tests. The producers designate the hybrids they want entered in each area. Hybrids must be submitted for entry to the Mississippi Agricultural and Forestry Experiment Station by Feb. 15. A nominal fee is charged for each hybrid tested in each area to help defray costs of the test.

Two or more tests were located in each area. Trials were conducted at 10 locations in 1978 (Table 1).

The best guide to the desirability of a hybrid is its performance over a period of years at a number of locations. Therefore, three-year summaries are reported for each area.

Table 1. Location, number of entries and dates of planting and harvest of hybrid corn performance trials in Mississippi, 1978.

County	Location	No. of entries	Planting date	Harvest date
Marshall	Holly Springs	49	April 24	Sept. 28
Pontotoc	Pontotoc	49	April 19	-------
Lee	Verona	49	April 25	Sept. 29
Noxubee	Brooksville	49	April 17	Oct. 2
Oktibbeha	Mississippi State	49	March 30	Sept. 19-20
Washington	Stoneville	49	March 29	Sept. 5-6
Newton	Newton	57	March 27	-------
Hinds	Raymond	57	April 4	Sept. 12
Wilkinson	Woodville	57	March 28	Sept. 7
Pearl River	Poplarville	57	March 15	Aug. 8 & 10

Materials and Methods

Major changes in the testing program in 1978 were redesignation of test areas and addition of tests at higher plant populations. Areas I and II in earlier trials were combined to form the new Area I. The new Area II includes areas designated as III and IV in previous tests. Tests at populations of 16,000 plants per acre were continued, and tests at populations of 22,000 plants per acre were added at each location.

A randomized complete-block experimental design with three replications at each population level was used at all locations. Each plot consisted of two rows, 40 inches apart and 200 inches long. All tests were overplanted and later thinned to either 16,000 or 22,000 plants per acre. Fertilizer was applied by each cooperator as he thought necessary and weeds were controlled by cultivation and herbicides.

All tests were harvested with a mechanical picker-sheller. Grain harvested from each plot was weighed, and moisture content was determined. All weights were converted to bushels per acre at 15.5% moisture.

All hybrids included in three-year summaries for Area I (1978 designation) were grown in both Area I and Area II in 1976 and 1977, and those included in three-year summaries for Area II (1978 designation) were grown in Area III and Area IV in the two previous years. However, results reported for each area in 1976 and 1977 include only those hybrids entered for testing by producers and/or distributors.

Test Results Area 1

The test at Pontotoc was not harvested because yields were near zero as the result of extreme drought. Results of the tests at Holly Springs and Mississippi State were discarded. Yields at Holly Springs were quite low and highly variable, because heavy rain shortly after planting reduced stands, and dry weather late in the year limited plant development. Yields at Mississippi State were quite good but highly variable, possibly because irrigation was not uniform. Results of the Brooksville test with populations of 16,000 plants per acre were discarded because of extreme yield variability.

The trials at Stoneville suffered severe damage from a hail storm early in the season. A heavy natural incidence of maize dwarf mosaic at Brooksville reduced yield of susceptible hybrids.

Average yields of the 49 hybrids tested at populations of 16,000 plants per acre at Stoneville and Verona ranged from 65 to 113 bushels per acre (Table 2). Stalk lodging ranged from 9 to 87% at Stoneville, from 0 to only 15% at Verona, and stalk lodging of five of the hybrids grown at the two locations averaged less than 10%. Root lodging was serious for only a few hybrids.

Average yields of the 49 hybrids tested at populations of 22,000 plants per acre at Brooksville, Stoneville and Verona ranged from 74 to 110 bushels per acre (Table 3). Stalk lodging averaged over the three locations ranged from 3 to 31%.

Yields of hybrids tested at populations of 22,000 plants per acre at Stoneville and Verona averaged 12 bushels more than when tested at the lower plant population level. No practical differences in other performance characteristics were observed.

Average yields of the 19 hybrids that have been tested at populations of 16,000 plants per acre in Area I for the past three years ranged from 81 to 114 bushels per acre (Table 4). The percentage range for stalk lodging was from 6 to 33.

Table 2. Summary of performance of 49 hybrids grown at two locations (Stoneville and Verona) at 16,000 plants per acre in the 1978 Mississippi hybrid corn performance trials.

			Lodging					
Hybrid	**Brand**	**Yield**	**root**	**stalk**	**Ear height**	**Days to mid silk***	**Moisture**	**Stand**
no.		bu/A	%	%	cm.	no.	%	%
X5505	Pioneer	113.0	5	23	153	78	16.5	108
PX95	Northrup King	109.8	0	12	150	74	15.1	100
RX114	Asgrow	108.5	11	15	129	75	15.5	100
3147	Pioneer	106.7	2	16	140	75	16.0	98
RX140A	Asgrow	104.9	13	9	132	76	16.3	100
RA2601	Ring Around	104.5	0	15	129	75	17.4	102
72-44A	McCurdy	102.8	0	8	136	75	15.9	98
9997	Wilstar	101.5	1	13	129	74	17.2	100
55	Dixie	101.4	5	41	161	78	17.4	80
PX715	Northrup King	101.0	0	15	138	73	16.0	101
XL394	DeKalb	97.9	4	15	140	77	16.8	104
G-4880W	Funk's	95.8	4	19	136	78	16.4	107
G-795W	Funk's	95.7	3	20	138	76	16.8	100
22	Coker	94.6	2	12	131	75	15.2	99
488	McNair	93.8	2	20	153	82	18.7	103
3179	Pioneer	93.0	3	23	132	76	16.0	92
XL78	DeKalb	91.2	0	12	120	74	16.0	96
G-4574	Funk's	91.0	0	18	127	74	16.5	98
MSX84aa	McCurdy	90.2	0	15	124	74	16.3	97
6131	Miss	89.4	7	51	156	78	16.6	98
3369A	Pioneer	88.9	0	16	121	74	15.5	94
9990	Wilstar	88.9	2	17	123	74	16.2	95
18A	Coker	88.5	0	15	132	74	15.5	99
3145	Pioneer	87.8	0	8	137	74	16.4	96
S-338	McNair	87.7	3	18	131	76	16.4	96
X-170	McNair	87.5	1	5	111	74	16.1	100
XL72b	DeKalb	86.7	1	11	118	74	15.2	92
77	Coker	86.5	4	25	162	78	16.0	98
751	P-A-G	86.5	1	33	152	79	16.5	103
G-4611	Funk's	86.3	0	15	124	74	15.1	92
PX723	Northrup King	84.3	1	14	140	74	15.4	105
511A	Pioneer	83.4	3	25	143	75	15.4	99
TXS114	Trojan	82.9	2	25	131	74	15.0	102
G-4709	Funk's	82.5	1	18	120	75	16.1	95
3368A	Pioneer	81.3	0	16	111	74	16.2	90
RA2655	Ring Around	80.4	0	18	126	74	16.3	94
RA2602W	Ring Around	80.1	4	22	135	75	16.7	93
G-4776	Funk's	79.9	0	11	143	75	15.7	101
3009	Pioneer	79.6	1	26	136	74	17.4	96
G-4606	Funk's	77.4	0	12	120	74	15.6	100
RA1502	Ring Around	77.3	0	31	116	73	16.3	96
G-4507	Funk's	76.2	0	23	127	74	15.6	99
G-4810	Funk's	74.7	1	6	129	74	16.6	92
TXS115A	Trojan	73.3	4	24	123	74	17.0	95
RA2502	Ring Around	71.8	0	18	108	73	16.7	98
6663	Wilstar	71.1	3	21	123	74	16.1	95
56	Coker	69.9	1	20	132	75	16.5	102
TX119A	Trojan	65.2	0	17	124	73	15.4	101
RA1501	Ring Around	64.9	5	23	128	74	15.1	98
MEAN		88.1	2	18	132	75	16.2	98

CV = 17.83%
LSD (.05) = 25.7 bu/A
***Data for Stoneville only**

Table 3. Summary of performance of 49 hybrids grown at three locations (Brooksville, Stoneville, Verona) at 22,000 plants per acre in the 1978 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk*	Moisture	Stand
no.		bu/A	%	%	cm.	no.	%	%
X5505	Pioneer	110.3	10	15	150	76	16.2	100
9997	Wilstar	105.2	6	13	126	75	16.6	94
MSX84aa	McCurdy	102.3	1	16	127	75	15.7	93
XL78	DeKalb	102.3	3	9	116	77	15.7	95
72-44A	McCurdy	101.8	1	10	138	76	14.9	97
RX140A	Asgrow	96.2	16	11	130	77	16.9	99
XL72b	DeKalb	96.2	3	7	114	76	14.9	100
G-4507	Funk's	95.2	9	16	121	78	15.8	100
3145	Pioneer	94.6	1	7	137	79	16.0	98
3147	Pioneer	94.6	1	11	133	75	15.3	93
511A	Pioneer	93.8	5	18	138	76	15.3	100
3179	Pioneer	93.5	6	25	136	77	15.3	96
RA2601	Ring Around	93.2	9	13	127	76	16.5	94
G-4776	Funk's	92.4	1	11	141	76	16.0	98
G-4810	Funk's	91.5	4	8	134	78	16.5	97
G-4606	Funk's	90.8	1	10	122	75	15.2	93
TXS115A	Trojan	90.1	8	13	124	76	14.9	91
3368A	Pioneer	89.9	1	12	125	77	15.5	96
22	Coker	89.0	1	16	125	77	15.1	97
RA1502	Ring Around	88.5	1	16	121	76	15.9	91
RX114	Asgrow	88.1	14	16	124	76	15.7	99
G-4709	Funk's	87.9	6	13	123	76	15.8	94
XL394	DeKalb	87.6	16	13	152	76	16.1	96
6663	Wilstar	87.3	7	21	126	75	15.3	93
PX715	Northrup King	87.0	1	9	140	77	15.2	92
G-4880W	Funk's	87.0	2	12	136	77	15.9	95
G-4574	Funk's	86.8	2	19	130	77	15.0	97
PX723	Northrup King	86.8	7	19	137	76	15.7	91
RA1501	Ring Around	86.7	8	15	129	76	15.0	92
56	Coker	86.5	1	11	137	77	16.3	98
3369A	Pioneer	86.2	1	30	124	75	15.3	90
S-338	McNair	85.8	5	19	129	76	16.8	95
RA2602W	Ring Around	85.5	10	14	139	76	16.4	89
G-4611	Funk's	85.1	6	16	128	77	16.0	95
TXS114	Trojan	84.9	0	15	119	77	15.7	91
PX95	Northrup King	84.8	6	7	147	77	15.8	90
9990	Wilstar	84.8	5	14	114	77	15.3	93
TX119A	Trojan	83.8	1	13	118	77	15.1	98
18A	Coker	83.0	2	11	124	76	16.1	90
X-170	McNair	81.8	3	3	110	77	15.9	95
3009	Pioneer	81.4	16	18	120	77	16.9	94
RA2502	Ring Around	80.1	1	20	108	77	16.2	94
55	Dixie	80.0	5	22	152	77	15.9	93
G-795W	Funk's	78.8	7	22	135	76	16.3	94
RA2655	Ring Around	78.2	2	16	121	77	15.1	94
77	Coker	75.9	9	13	157	77	16.1	95
6131	Miss	75.9	8	31	155	77	15.9	97
488	McNair	74.9	5	12	139	79	16.9	97
751	P-A-G	74.2	10	16	145	77	16.1	100
MEAN		88.3	5	15	131	77	15.8	95

CV = 16.64%
LSD (.05) = 24.0 bu/A
***Data for Stoneville only**

Table 4. Three-year (1976-78) average performance of 19 hybrids grown in Area I at 16,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk	Moisture	Stand
no.		bu/A	%	%	cm.	no.	%	%
3147	Pioneer	113.5	1	10	136	80	17.5	94
XL394	DeKalb	112.8	2	8	143	78	18.2	99
77	Coker	110.4	2	12	153	80	17.5	95
9997	Wilstar	110.3	1	9	125	76	18.7	95
3145	Pioneer	108.0	0	6	134	75	17.9	93
72-44A	McCurdy	106.2	0	8	129	75	17.1	98
6131	Miss	105.4	3	33	157	80	16.9	97
G-795W	Funk's	103.6	3	18	133	77	17.6	94
G-4880W	Funk's	103.1	2	10	136	81	18.1	99
G-4776	Funk's	100.3	0	9	140	76	17.7	96
55	Dixie	99.6	4	26	159	80	18.1	89
3009	Pioneer	97.4	2	16	138	77	19.4	95
56	Coker	96.2	1	10	132	79	18.0	95
511A	Pioneer	95.5	3	16	138	78	17.0	95
XL72b	DeKalb	94.8	1	8	110	74	16.8	95
9990	Wilstar	94.6	1	12	117	76	17.5	93
G-4611	Funk's	92.7	0	9	122	74	15.9	91
G-4810	Funk's	91.3	1	6	128	75	17.8	96
6663	Wilstar	80.8	2	10	121	74	16.3	93
MEAN		100.9	2	12	134	77	17.6	95

Test Results Area 2

The test at Newton was discarded before harvest because of circumstances beyond the control of the cooperator. Results of one replication of the Poplarville test with populations of 16,000 plants per acre were discarded. Two windstorms caused severe stalk lodging in the Raymond test.

Average yield per acre, root lodging and stalk lodging of the 57 hybrids tested at populations of 16,000 plants per acre were, respectively, 78 bushels and 1 and 7% at Poplarville; 64 bushels and 20 and 17% at Raymond and 65 bushels and 1 and 10% at Woodville. Yields, root lodging and stalk lodging averaged, respectively, from 45 to 83 bushels per acre, 0 to 19% and 1 to 25% (Table 5). Harvesting techniques used in plots where lodging was severe generally were more precise than would be feasible on a commercial scale; therefore, yields obtained from these plots likely were higher than they would have been with a normal harvesting operation.

Average yields of these 57 hybrids tested at populations of 22,000 plants per acre at the same locations ranged from 60 to 102 bushels per acre (Table 6). Average yields, root lodging and stalk lodging, respectively, were 13 bushels per acre, 3% and 7% higher at this plant population than at 16,000 plants per acre.

Average yields of the 23 hybrids that have been tested at populations of 16,000 plants per acre in Area II for the past three years ranged from 68 to 83 bushels per acre (Table 7). The percentage range for stalk lodging was from 4 to 25.

Table 5. Summary of performance of 57 hybrids grown at three locations (Poplarville, Raymond and Woodville) at 16,000 plants per acre in the 1978 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
no.		bu/A	%	%	cm.	%	%
76-25	McCurdy	82.8	1	10	134	16.9	96
UC12052	Paymaster	82.3	7	1	110	19.3	89
3147	Pioneer	81.0	1	9	105	15.4	96
3030	Pioneer	80.7	9	6	113	17.0	94
RA3602	Ring Around	79.7	7	15	118	16.0	93
MSX86A	McCurdy	79.5	2	13	103	16.1	93
XL80	DeKalb	79.2	14	7	97	16.2	92
G-4864	Funk's	78.3	6	7	114	17.0	93
X5505	Pioneer	77.3	11	6	128	16.6	93
67-14	McCurdy	77.0	12	9	103	18.9	92
RA2601	Ring Around	76.0	10	12	107	17.9	90
XL394	DeKalb	75.6	15	9	130	17.3	94
75-200	McCurdy	75.3	17	12	122	18.4	93
55	Dixie	75.1	12	25	134	17.1	89
S-338	McNair	74.7	19	18	113	16.7	92
PX65	Northrup King	74.1	13	16	107	15.2	89
3368A	Pioneer	72.8	2	10	100	16.3	89
G-4709	Funk's	72.6	8	5	110	17.2	94
G-4880W	Funk's	72.2	6	7	115	17.1	95
G-795W	Funk's	72.0	19	19	112	17.2	93
G-4949A	Funk's	71.7	13	2	123	17.1	94
22	Coker	71.4	1	11	109	15.5	90
511A	Pioneer	71.4	11	16	117	17.0	94
G-4574	Funk's	71.3	7	18	104	16.3	91
77	Coker	71.2	3	5	130	17.3	90
3040	Pioneer	71.0	12	3	106	17.5	91
9997	Wilstar	70.7	10	9	106	17.8	94
RA1502	Ring Around	70.3	0	5	100	16.8	95
RX140A	Asgrow	70.0	18	6	112	17.7	91
G-4507	Funk's	69.8	1	19	108	15.5	91
3145	Pioneer	69.6	3	11	108	16.9	89
3369A	Pioneer	69.1	1	9	93	15.4	92
PX715	Northrup King	69.1	0	8	112	16.6	89
751	P-A-G	67.8	8	24	138	17.8	92
PX723	Northrup King	67.8	5	17	110	16.6	90
PX79	Northrup King	66.3	4	8	107	16.0	89
3009	Pioneer	66.0	13	11	114	17.4	91
G-4606	Funk's	65.7	3	16	103	16.3	91
18A	Coker	65.2	2	12	110	16.0	91
54	Coker	64.6	11	13	113	17.7	94
G-4611	Funk's	63.3	6	12	103	15.9	87
RA2502	Ring Around	63.1	0	9	90	15.8	91
PX675	Northrup King	62.9	4	17	105	16.5	88
PX95	Northrup King	62.8	1	10	119	17.0	92
G-4810	Funk's	62.7	9	9	107	15.8	91
X4537	Pioneer	62.5	3	4	93	17.9	93
56	Coker	62.1	5	12	119	17.5	93
G-5945	Funk's	61.4	18	10	128	16.9	89
TXS114	Trojan	60.6	1	24	103	16.4	87
XL78	DeKalb	60.2	2	22	96	15.7	91
G-4776	Funk's	59.2	2	8	119	16.4	87
TXS115A	Trojan	56.8	3	17	101	15.2	87
6131	Miss	56.7	9	25	125	16.2	89
488	McNair	56.4	10	5	125	19.2	96
XL395	DeKalb	55.2	6	15	131	17.4	87
TX119A	Trojan	54.4	1	9	99	14.9	92
X-170	McNair	47.9	9	13	94	15.3	87
MEAN		68.9	7	12	112	16.8	91

CV = 18.42%

LSD (.05) = 25.4 bu/A

Table 6. Summary of performance of 57 hybrids grown at three locations (Poplarville, Raymond and Woodville) at 22,000 plants per acre in the 1978 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging		Ear height	Moisture	Stand
			root	stalk			
no.		bu/A	%	%	cm.	%	%
MSX86A	McCurdy	102.3	2	15	118	16.4	92
X4537	Pioneer	96.5	9	2	101	18.1	92
22	Coker	96.4	9	19	116	17.0	90
3147	Pioneer	95.4	14	8	119	17.3	87
G-4606	Funk's	94.2	4	25	113	17.3	93
UC12052	Paymaster	93.5	15	3	119	19.2	85
X5505	Pioneer	92.8	9	14	132	17.3	93
XL394	DeKalb	91.2	17	15	128	19.0	88
G-4574	Funk's	91.1	7	27	118	16.6	86
3030	Pioneer	90.2	14	10	131	19.3	89
3368A	Pioneer	90.0	4	14	103	16.5	86
3369A	Pioneer	88.6	8	23	105	16.2	89
18A	Coker	88.3	5	9	108	16.8	90
67-14	McCurdy	87.4	10	31	108	18.0	82
G-4864	Funk's	87.0	10	11	128	17.1	89
RA2601	Ring Around	86.7	16	29	117	18.8	89
3040	Pioneer	86.4	17	7	122	18.9	88
G-4507	Funk's	86.4	10	24	115	16.5	86
3145	Pioneer	86.1	3	13	119	17.0	88
TXS114	Trojan	85.2	5	17	108	16.4	86
RA1502	Ring Around	84.5	4	12	108	16.5	90
PX723	Northrup King	84.2	7	22	134	16.6	84
RA2502	Ring Around	83.7	0	21	99	17.0	89
RA3602	Ring Around	83.6	2	31	118	17.2	84
3009	Pioneer	83.5	7	27	125	17.9	88
77	Coker	83.4	8	17	147	18.0	90
G-4776	Funk's	82.0	3	20	128	17.6	89
G-4810	Funk's	82.0	11	12	114	16.9	87
G-795W	Funk's	81.7	8	23	122	17.3	88
9997	Wilstar	80.9	17	15	113	18.0	88
XL80	DeKalb	80.8	22	8	99	16.5	89
75-200	McCurdy	80.5	11	23	128	18.0	86
TXS115A	Trojan	80.5	7	20	111	15.9	84
RX140A	Asgrow	79.4	27	8	124	17.8	88
XL78	DeKalb	79.2	3	27	103	16.6	89
G-4709	Funk's	79.1	17	12	113	16.9	90
PX95	Northrup King	78.9	2	27	132	16.9	87
XL395	DeKalb	78.9	19	8	139	18.1	86
PX675	Northrup King	78.8	17	18	111	16.9	88
54	Coker	78.3	9	30	119	18.5	90
76-25	McCurdy	77.7	4	21	141	18.8	94
55	Dixie	77.4	8	41	137	17.5	88
511A	Pioneer	77.0	8	27	126	17.1	93
PX715	Northrup King	76.4	1	23	120	16.7	91
G-4949A	Funk's	75.3	17	9	124	18.3	92
PX79	Northrup King	75.2	13	17	118	16.5	89
X-170	McNair	74.9	12	20	95	15.4	87
G-4611	Funk's	74.4	11	19	114	17.0	87
PX65	Northrup King	72.4	8	25	113	15.7	91
S-338	McNair	71.9	7	41	118	17.9	83
G-4880W	Funk's	69.2	11	12	122	18.5	91
56	Coker	68.7	1	27	126	18.4	88
488	McNair	64.5	12	12	131	19.3	88
TX119A	Trojan	64.0	4	20	103	16.3	87
751	P-A-G	63.9	9	25	141	17.3	83
G-5945	Funk's	60.8	20	24	135	17.2	88
6131	Miss	59.9	8	44	143	17.6	86
MEAN		81.5	10	19	120	17.4	88

CV = 18.93%
LSD (.05) = 25.2 bu/A

Table 7. Three-year (1976-78) average performance of 23 hybrids grown in Area II at 16,0 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Mois-ture	Sta
no.		bu/A	%	%	cm.	%	%
77	Coker	82.9	1	5	128	18.6	96
3147	Pioneer	81.6	1	11	106	18.1	97
3030	Pioneer	79.1	3	8	110	19.7	96
G-4949A	Funk's	78.5	4	4	120	18.6	96
3145	Pioneer	78.3	1	9	104	18.5	94
XL394	DeKalb	77.7	6	6	123	18.7	96
55	Dixie	77.0	5	22	131	19.1	94
XL395	DeKalb	76.5	2	8	124	19.5	94
3009	Pioneer	75.8	5	10	111	19.8	95
G-5945	Funk's	75.6	6	7	124	18.8	94
G-4864	Funk's	75.4	2	7	107	17.8	95
3368A	Pioneer	74.2	1	8	95	17.4	94
511A	Pioneer	73.5	4	12	109	18.5	96
RA2601	Ring Around	73.3	3	8	103	19.7	90
3369A	Pioneer	72.9	0	11	89	16.9	95
G-4810	Funk's	72.7	3	9	104	18.4	96
G-795W	Funk's	72.6	7	20	109	18.5	95
G-4776	Funk's	72.5	1	9	115	17.7	94
9997	Wilstar	72.1	4	10	105	20.2	96
G-4880W	Funk's	71.7	2	6	108	18.3	97
56	Coker	69.7	2	13	117	18.6	96
54	Coker	69.2	4	10	111	19.1	94
6131	Miss	68.1	4	25	124	18.5	93
MEAN		74.8	3	10	112	18.7	95

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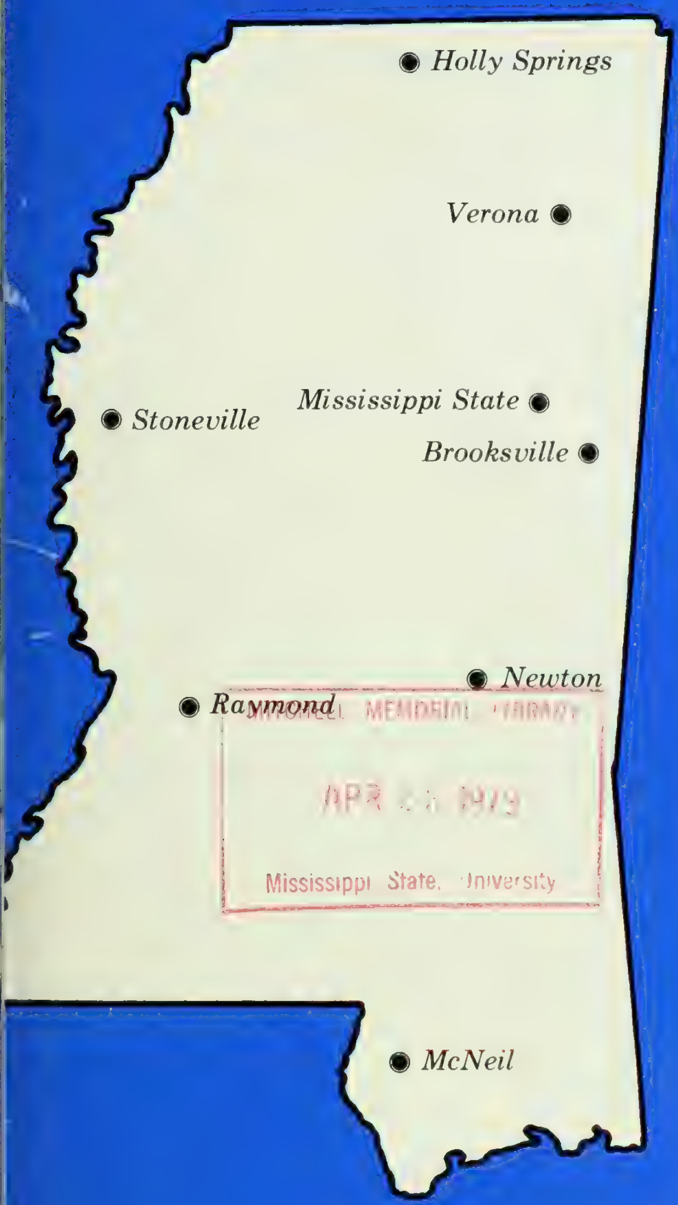
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Mississippi Grain Sorghum Performance Trials in 1978

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Mississippi Grain Sorghum Performance Trials 1978

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February 1979

Mississippi Grain Sorghum Performance Trials in 1978

Trials are conducted annually in Mississippi to provide farmers, seedsmen, county agents, and other interested persons with information on performance of commercially available grain sorghum hybrids. Results are particularly helpful to grain sorghum producers in selecting hybrids suited to their area.

We tested 52 commercial and experimental hybrids at seven locations in Mississippi in 1978 (Table 1). A good test of performance cannot be made if damaging populations of insects are present; therefore, insecticides were applied as needed. See MAFES Bulletins 817 and 836 for methods of control of insects on grain sorghum.

Resistance to diseases is important in selecting a hybrid for areas where diseases are a problem. Also, planting at the recommended time helps reduce damage caused by diseases and insects.

Quantity of harvested good-quality grain (or silage) is the best guide to the desirability of sorghum hybrids. Performance data for each hybrid tested in 1978 are presented in this report; however, performance data for any one year may be misleading. Therefore, the two- and three-year average yields of hybrids that have been evaluated for these periods of time also are presented.

Table 1. Planting dates, fertilizer rates (lbs/A), and insecticides applied, Hybrid Grain Sorghum Performance Trials, by location of trials, Mississippi, 1978.

Location	Planting date	Fertilizer rates[1]	Insecticides applied[2]
Mississippi State	April 25	40-40-40 PP 125-0-0 SD	3-diazinon
Brooksville	May 22	40-40-40 PP 150-0-0 SD	None
Verona	April 27	45-45-45 PP 100-0-0 SD	None
Newton	May 25	65-65-65 PP	None
McNeil	June 20	68-60-100 PP 34-0-0 SD	2-diazinon
Holly Springs	May 22	60-60-60 PP 60-0-0 SD	2-sevin
Raymond	May 2	0-72-72 PP 100-0-0 SD	None

[1] **SD = Sidedressed, PP = Preplant.**

[2] **Insecticides applied as labeled.**

Testing Procedures

A randomized complete block design with four replications was used at all locations. Each plot consisted of two rows 38 or 40 inches wide and 20 ft long. All trials were planted at the rate of 7 lbs of seed per acre. Heads from 13 ft of each plot were hand-harvested, dried and threshed, and grain yield was adjusted to 14% moisture. Data reported have not been adjusted for bird damage, but trials with average bird damage of more than 25% were not harvested. Planting dates, fertilizer rates and insecticides applied are presented in Table 1.

Table 2. Performance of 40 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location, 1978.

							Yield							
Hybrid	50% Bloom[1]	Plant height[2]	Fusarium[3]	Anthracnose[3]	Bird damage[4]	Test weight[5]	Miss. State	Brooksville	Verona	Newton	McNeil	Holly Springs	Raymond	Mean
	(days)	(in)	------rating------		(%)	(lbs/bu)	------------------------------lbs/A------------------------------							
T E Dinero	69	39	1	0	6	58.8	6313	4125	4190	1586	3031	5445	5842	4362
Paymaster R 1090	68	43	0	2	0	58.4	6397	4257	3258	2432	3292	5034	5427	4300
Coker 7675	70	41	0	0	3	58.0	6623	3755	2968	2122	2809	5920	5293	4213
T T Two 70-D	70	42	1	0	6	59.6	6043	3430	4703	2058	2625	5065	5210	4162
Coker 7638	68	39	2	0	3	59.0	6648	2968	3704	2256	2693	5540	5313	4160
Funk's G522DR	69	40	2	0	2	58.2	6201	3868	3737	1623	2507	5952	5157	4149
Funk's G622	68	39	0	3	5	58.5	5850	3816	3944	2113	3091	4464	5536	4116
Paymaster DR 1085	69	41	2	0	6	59.3	6233	3299	3985	1918	2475	6015	4669	4085
Paymaster R 1029-A	70	41	1	0	11	58.2	4745	3941	3942	2256	2706	5445	5507	4077
Warner W-839 DR	68	41	1	0	5	59.0	6561	3430	4176	1601	2685	5318	4756	4075
T.T. Two 62yG	69	41	0	1	6	58.9	5643	3127	3937	2076	2856	5318	5408	4052
Asgrow Topaz	70	40	0	0	5	59.6	6677	3464	4185	1029	2813	5034	5150	4050
Wilstar 1225	68	39	0	0	4	58.0	5714	3779	4669	1811	2112	5382	4736	4029
Wilstar 1425	70	43	2	0	6	55.6	6558	3782	3338	1309	1467	5698	5904	4008
Funk's G522	68	38	0	2	4	57.7	6162	3837	3182	1729	2830	5540	4741	4003
Pioneer brand 8225	69	44	0	0	14	59.4	5360	3611	3963	2161	2304	5382	5209	3999
DeKalb C-42y+	70	42	0	0	11	57.3	5840	4134	3540	1851	2424	4495	5664	3993
DeKalb F-67	70	40	0	3	11	57.0	5563	3684	3990	1729	2813	4527	5408	3959
ML 135	68	40	2	0	8	58.6	6098	3391	3430	1428	3023	4812	5396	3940
McNair 650	69	39	0	0	6	58.0	5608	3626	3332	1635	2937	5192	5203	3933
Pioneer brand 8311	69	41	0	0	6	58.7	5424	3045	3420	2174	2543	6205	4604	3916
Paymaster R 109A	68	40	1	0	6	58.2	5186	3681	3194	2262	2907	4970	5042	3892
DeKalb D-59+	70	42	0	0	13	57.3	5489	3660	3873	1822	2505	4590	5044	3855
Coker 7707	70	44	1	0	9	57.8	5147	3017	3495	1598	2706	5287	5440	3813
T E Y 101 D	69	41	1	0	8	59.7	5647	3189	3670	1989	2719	4337	5035	3798
Wilstar 1330	69	46	2	0	17	56.6	4258	3896	3707	1355	3099	5318	4845	3783
Paymaster DR 1035	69	41	2	0	5	59.0	5360	3840	2787	2222	2642	5255	4238	3763
Funk's HW 2215	70	46	2	0	8	58.1	4484	3929	4428	1157	2591	4115	5627	3762
RA 808gb	71	42	2	0	7	57.4	4390	3440	3762	1540	2659	5287	4984	3723
Funk's G642GBR	72	43	1	0	8	55.9	6104	3388	2763	1406	1668	5382	5248	3708
T-E Y-101-R	69	39	1	0	6	58.8	4893	3176	3242	2125	2881	4812	4777	3701
N.K. brand 2884	69	44	0	0	10	57.4	5263	2846	3646	1741	2736	4242	5170	3663
Funk's G622GBR	69	38	2	0	7	57.8	4857	3235	3539	2143	2971	3989	4825	3651
N.K. brand 2779	67	38	0	0	6	58.6	5334	3085	3452	2320	2642	4147	4495	3639
N.K. brand 2650	70	46	0	0	7	58.4	5447	2956	3345	1991	1868	5192	4638	3634
Coker 7605	68	42	0	2	5	58.9	6098	1952	3674	1717	2663	4432	4730	3609
RA 811Agb	71	41	1	0	11	57.6	4803	3403	3661	1206	2163	4654	5098	3570
Pioneer brand 8272	70	39	1	0	9	56.0	5231	2797	4418	1650	2101	3641	4583	3489
Funk's HW 2195	72	38	0	0	5	59.4	5437	3813	3964	1333	2681	2343	4678	3464
N.K. brand 2266	68	44	1	0	8	59.5	5212	2662	2875	1900	1868	4495	3131	3163
Mean	69.2	41.2	0.8	0.3	7.2	58.2	5623	3458	3677	1809	2603	4957	5044	3882
L.S.D. (.05)							1034	520	1310	796	523	1153	1046	...
C.V.							13.3%	10.8%	25.7%	31.7%	14.5%	16.8%	15.0%	...

[1] Average of Mississippi State, Verona, Newton, and Raymond.
[2] Average of Mississippi State, Newton, Holly Springs, and Raymond.
[3] Average of Meridian, MS. Rating of 0 = no disease symptoms, 4 = disease killed plants.
[4] Average of Mississippi State and Verona.
[5] Average of Mississippi State, Brooksville, Verona, and Newton.

Table 3. Performance of 12 bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location 1978.

						Yield							
Hybrid	50% Bloom[1]	Plant height[2]	Fusarium[3]	Anthracnose[3]	Test weight[4]	Miss. State	Brooksville	Verona	Newton	McNeil	Holly Springs	Raymond	Mean
	(days)	(in)	------rating------		(lbs/bu)	------------------------------lbs/A------------------------------							
Paymaster BR-Y93	70	42	0	2	57.7	3759	4979	5025	2856	2920	4527	5902	4281
N.K. Savanna 5	70	45	2	0	58.6	4186	4407	5346	2353	3106	3894	6298	4227
Coker 7681BR	70	39	2	0	57.8	3907	3905	5336	2441	2905	3862	6107	4066
T.T. Two 75BRG	70	41	2	0	56.2	3756	4082	4804	2265	3104	4021	6267	4043
Pioneer brand B815	70	43	1	0	58.5	3150	4260	5471	2448	2740	3609	5896	3939
Funk's G516BR	71	39	2	0	56.4	3313	4006	4561	2280	2663	4084	6323	3890
GSA 1334BR	71	40	2	2	56.8	3650	4373	4883	2119	2851	3609	5660	3878
Warner W-744DR	70	39	1	1	58.3	3943	4474	4408	1942	3232	2944	5820	3823
DeKalb BR-65+	71	43	2	0	56.0	3769	3632	4330	2490	2487	3641	5435	3683
DeKalb BR-45+	69	39	2	0	59.2	3508	3629	3124	2758	2569	4749	5241	3654
Coker 7652BR	69	39	2	0	57.4	3791	3357	4217	2058	2407	4115	5484	3633
DeKalb BR-64	70	46	2	0	58.6	3153	3905	4107	2426	2462	3324	4971	3478
Mean	70.1	41.2	1.7	0.4	57.6	3657	4084	4634	2370	2787	3865	5784	3883
L.S.D. (.05)						953	811	1199	828	474	882	904	---
C.V.						18.8%	14.3%	18.7%	25.2%	12.3%	16.5%	11.3%	

[1] Average of Mississippi State, Verona, Newton, and Raymond, MS.
[2] Average of Mississippi State, Newton, Holly Springs and Raymond, MS.
[3] Average of Meridian, MS. Rating of 0 = no disease symptoms - 4 = disease killed plants.
[4] Average of Mississippi State, Brooksville, Verona and Newton, MS.

Results

Hybrids were separated into two ials at each location, 40 non-bird-esistant hybrids in one trial (Table) and 12 bird-resistant hybrids in ie other (Table 3). Bird damage to ie non-bird-resistant hybrids was ppreciable only at Mississippi tate and Verona, probably due to ie early planting date at these two ocations. Bird damage of the non-ird-resistant hybrids ranged from to 14% at Mississippi State, from 1 25% at Verona and averaged 7% or both locations.

Lodging was negligible at all ocations, probably due to the educed plant height resulting om drought.

Grain yield of the 40 non-bird-esistant hybrids in the 1978 trials anged from 1029 lbs per acre for sgrow Topaz in the Newton trial 6677 for Asgrow Topaz in the lississippi State trial. Yields of the 0 hybrids averaged 3882 lbs per cre for the seven test locations Table 2).

Grain yield of the 12 bird-esistant hybrids in the 1978 trials anged from 1942 lbs per acre for Varner W-744DR in the Newton trial to 6323 lbs for Funk's G516BR in the Raymond trial. Yield of the 12 hybrids averaged 3883 lbs per acre for the seven test locations (Table 3). Yields of all hybrids in the state were reduced by prolonged drought.

Three-year average yields of non-bird-resistant and bird-resistant hybrids are reported in Tables 4 and 5, respectively. Two-year average yields of both classes of hybrids are reported in Tables 6 and 7, respectively.

Table 4. Yield of 14 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for three years, 1976-78.

	Locations		
Hybrid	**McNeil**	**Raymond**	**Mean**
	lbs/A		
GSA ML135	4175	4673	4424
Wilstar 1425	3592	4862	4227
Funk's G522	3872	4376	4124
Paymaster R 1090	3854	4374	4114
Pioneer brand 8311	3837	4359	4098
Ringaround 808gb	3748	4416	4082
Paymaster R 109A	3596	4543	4070
Funk's G622GBR	3873	4258	4066
Paymaster R 1029-A	3871	4259	4065
T. T. Two 62yG	3755	4064	3910
Wilstar 1225	3542	4234	3888
Wilstar 1330	3963	3700	3832
T-E Y-101-R	3568	4017	3792
Paymaster DR 1085	3771	3807	3789
Mean	3787	4282	4034

Table 5. Yield of eight bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for three years, 1976-78.

	Locations				
Hybrid	**Miss. State**	**Verona**	**McNeil**	**Raymond**	**Mean**
	lbs/A				
N. K. Savanna 5	4874	6137	4730	5157	5224
Paymaster BR-Y93	5433	5861	4486	4733	5128
GSA 1334BR	5344	5846	4518	4690	5100
Pioneer brand B815	4614	6197	4158	4970	4985
Funk's G516BR	5214	5241	4404	4698	4889
Warner W-744DR	5044	5568	4170	4691	4868
DeKalb BR-65+	4960	5430	4056	4411	4714
DeKalb BR-64	5009	5322	4248	3861	4610
Mean	5062	5700	4346	4651	4940

Table 6. Yield of 22 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for two years, 1977-78.

Hybrid	Miss. State	Verona	Newton	McNeil	Holly Springs	Raymond	Mean
	lbs/A						
Paymaster R 1090	5646	4322	2626	3094	5183	4673	4257
Funk's G522DR	5514	4731	2228	2936	4838	4508	4126
Warner W-839DR	5715	4188	2076	3414	4247	4210	3975
Wilstar 1425	5617	4180	2030	2100	4983	4924	3972
Funk's G522	5466	4020	2199	2963	4962	4216	3971
GSA ML135	5458	3642	2032	3280	4768	4595	3962
McNair 650	5308	4328	2284	3464	3850	4454	3948
Paymaster R 1029-A	4440	4038	2458	3052	5086	4500	3929
Pioneer brand 8311	4692	4111	2326	2878	5308	4032	3891
T. T. Two 62yG	5052	4438	2453	2624	4581	4058	3868
Paymaster R 109A	4897	3818	2270	3049	4750	4418	3867
Wilstar 1225	5033	4818	2184	2263	4716	4116	3855
Paymaster DR 1085	5479	4003	2394	2688	4577	3922	3844
Funk's G622GBR	4420	4015	2518	2890	4070	4280	3699
T-E Y-101-R	4549	3758	2450	2986	4282	4050	3679
DeKalb C-42y+	4762	3375	2203	2786	4020	4862	3668
Pioneer brand 8272	4628	4537	2044	2372	4265	4156	3667
Ringaround 808gb	4345	3868	2214	2655	4502	4302	3648
Pioneer brand 8225	3931	3454	2652	2530	4996	4321	3647
Funk's G642GBR	5356	3518	1916	2123	4432	4340	3614
N.K. brand 2779	4775	4096	2328	2517	3734	3864	3552
Wilstar 1330	4324	3252	1946	2929	4234	4505	3532
Mean	4973	4023	2265	2903	4563	4332	3843

Table 7. Yield of nine bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for two years, 1977-78.

Hybrid	Miss. State	Verona	Newton	McNeil	Holly Springs	Raymond	Mean
	lbs/A						
N. K. Savanna 5	4274	5818	3144	3744	3864	5054	4316
Paymaster BR-Y93	4480	5064	2458	3372	4948	4387	4118
Pioneer brand B815	3653	5934	2863	3158	4069	4492	4028
GSA 1334 BR	4344	5420	2546	3099	4204	4426	4006
Funk's G516BR	4200	4526	2536	3167	4234	4500	3860
Warner W-744DR	4118	5024	2336	3310	3850	4487	3854
T. T. Two 75BRG	4080	5228	2304	3028	3860	4316	3803
DeKalb BR-65+	3966	5085	2434	2809	3548	4406	3708
DeKalb BR-64	4060	5050	2822	3228	2786	3546	3582
Mean	4131	5239	2605	3213	3929	4402	3920

Hybrids Designated for Entry in the 1978 Mississippi Grain Sorghum Performance Trials, by Sponsers.

Hybrid	Company	Address
Asgrow Topaz	Asgrow Seed Co.	Des Moines, Ia.
Coker 7605	Coker's Pedigreed Seed Co.	Lubbock, Tex.
Coker 7638		
Coker 7675		
Coker 7707		
Coker 7652BR		
Coker 7681BR		
DeKalb C-42y+	DeKalb AgResearch, Inc.	Lubbock, Tex.
DeKalb D-59+		
DeKalb F-67		
DeKalb BR-45+		
DeKalb BR-64		
DeKalb BR-65+		
Funk's HW 2215	Louisiana Seed Co., Inc.	Plainview, Tex.
Funk's G522		
Funk's G516BR		
Funk's G622GBR		
Funk's G642GBR		
Funk's G622		
Funk's G522DR		
Funk's HW 2195		
Growers ML 135	Growers Seed Assn.	Lubbock, Tex.
Growers GSA 1334BR		
McNair 650	McNair Seed Co.	Laurinburg, N. C.
N.K. brand 2884	Northrup, King & Co.	Richardson, Tex.
N.K. Savanna 5		
N.K. brand 2650		
N.K. brand 2779		
N.K. brand 2266		
Paymaster BR-Y93	ACCO Seed Co.	Plainview, Tex.
Paymaster R 1029-A		
Paymaster DR 1035		
Paymaster DR 1085		
Paymaster R 1090		
Paymaster R 109A		
Pioneer brand B815	Pioneer Hi-Bred, Inc.	Tipton, Ind.
Pioneer brand 8311		
Pioneer brand 8225		
Pioneer brand 8272		
Ring Around RA 808gb	Ring Around Products, Inc.	Plainview, Tex.
Ring Around RA 811Agb		
T-E Y-101-D	Taylor-Evans Seed Co.	Tulia, Tex.
T-E Y-101-R		
T-E Dinero		
T.T. Two 75BRG	Texas Triumph Seed Co., Inc.	Ralls, Tex.
T.T. Two 62yG		
T.T. Two 70-D		

(continued)

Continued. **Hybrids Designated for Entry in the 1978 Mississippi Grain Sorghum Performance Trials, by Sponsors.**

Hybrid	Company	Address
Warner W-744DR Warner W-839DR	Warner Seed Co., Inc.	Hereford, Tex.
Wilstar 1225 Wilstar 1330 Wilstar 1425	Helena Chemical Co.	Memphis, Tenn.

Bulletin 879

March 1979

Mississippi Cotton Variety Tests in 1978

Holly Springs
Tunica
Verona
Sumner
Stoneville
Mississippi State

By
R. R. Bridge
J. F. Chism
B. L. Arnold
N. W. Buehring
A. G. Douglas

MAFES MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
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Mississippi State University

James D. McComas, President Louis N. Wise, Vice President

1878

Bulletin 879

Mississippi Cotton Variety Tests in 1978

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Mississippi Agricultural and Forestry Experiment Station
Mississippi State University

March 1979

Mississippi Cotton Variety Tests in 1978

Cotton varieties are evaluated each year in several Mississippi environments, and the results are reported as a guide to producers in selecting varieties most appropriate for their area. The 1978 trials were conducted in three Delta environments—Stoneville, Sumner and Tunica—and three hill area environments—Holly Springs, Mississippi State and Verona.

The 17 varieties tested at Stoneville and Tunica in 1978 are included in the Cooperative Regional Variety Testing Program. 'McNair 235', 'Coker 315', 'Deltapine 7141' and 'Rex 713' were evaluated for the first time. Two of the varieties included in the Stoneville and Tunica trials—'Acala SJ-5' and 'Paymaster 303'—were not evaluated at Sumner and three varieties—Acala SJ-5, Paymaster 303 and McNair 235—were not included in the trials at Holly Springs, Mississippi State and Verona.

Each entry was randomized and replicated six times. Yield determinations were based on weight of cotton harvested from two-row plots. Determinations of lint percentage, boll size, seed index and fiber properties were made from hand-picked samples. Fiber property evaluations were made in the U.S.D.A. Cotton Fiber Laboratory at Knoxville, Tennessee and the MAFES Cotton Fiber Laboratory at Stoneville.

Results

Delta, 1978

The Stoneville test was planted April 18 on a Bosket very fine sandy loam soil. Slow stand establishment and slow growth resulted from the excessive moisture and cool temperatures at planting time. The plants experienced drought stress in early July and the plots were irrigated on July 11 and July 25. The test was harvested on September 29. Lint yields ranged from 800 to 1126 lbs per acre (Table 1).

The Sumner test was planted April 21 on a Dubbs sandy loam soil. The test was harvested on October 6. Growing conditions at Sumner were poor at planting time, but each variety tested produced more lint in this trial than in either of the other Delta trials. Yields ranged from 1000 to 1407 lbs of lint per acre (Table 2).

Planting of the test at Tunica on a Dundee silt loam soil was delayed until May 17 because of excessive soil moisture and low temperatures. Excellent growing conditions resulted in good stands and rapid growth. The test was harvested twice, and maturity at first harvest on October 11 ranged from 75 to 89%. Lint yields ranged from 653 to 1110 lbs per acre (Table 3).

Average yield of the 15 varieties that were tested at each Delta location in 1978 ranged from 902 to 1214 lbs of lint per acre (Table 4). Lint yield of the 15 varieties averaged over the three Delta trials was 1085 lbs per acre.

Delta, Two-Year and Four-Year Averages

Lint yield of the eleven varieties grown in seven Delta environments over the two-year period (1977-78) ranged from 1016 to 1114 lbs per acre (Table 5). Nine varieties have been tested in 13 Delta environments for four years (1975-78). Average yields over this four-year period ranged from 814 to

912 lbs of lint per acre (Table 6). The small differences in average yields of commercially available varieties over a time period of this length indicate that factors other than yield need to be considered in variety selection.

Hill Area, 1978

The Mississippi State test was planted May 17 on a Leeper fine sandy loam soil. Lint yields ranged from 948 to 1257 lbs per acre (Table 7). Maturity on September 8 ranged from 14.6 to 31.4%.

Stands from the April 25 planting on Catalpa silty clay loam soil at Verona were poor, and the results are not reported. Lint yields of a second test planted May 17 on the same soil type ranged from 422 to 580 lbs per acre (Table 8).

The test at Holly Springs was planted May 11 on a Grenada silt loam soil. Lint yields ranged from 738 to 991 lbs per acre (Table 9). Maturity at first harvest on September 25 ranged from 44 to 64%.

Hill Area, Two-Year Averages

Nine varieties have been tested at Holly Springs for two years (1977-78). Average yields over this two-year period ranged from 762 to 845 lbs of lint per acre (Table 10). These small differences in average yields indicate that factors other than yield also need to be considered in selecting varieties for the hill area. One important factor is earliness, and the earliest of the commercially available varieties tested at Holly Springs have been DES 56, DES 24, Stoneville 731 N and Coker 304.

Table 1. Results of the 1978 Cotton Variety Test on Bosket very fine sandy loam soil at Stoneville, Miss.

	Lint per acre	Lint percent	Seed index	Boll size grams	Fiber Properties				
					Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire
McNair 235	1126	37.0	11.4	5.32	1.15	.58	19.48	7.0	4.8
DES 56	1124	36.0	10.8	4.84	1.17	.59	19.15	8.3	4.3
Deltapine 61	1054	35.9	10.5	5.41	1.17	.59	19.75	9.0	4.5
Coker 315	1039	36.0	11.3	5.21	1.21	.60	19.54	7.3	4.4
Deltapine 26	1035	38.1	10.0	4.80	1.16	.57	19.55	7.4	4.3
Deltapine 7141	1018	38.3	9.2	4.66	1.18	.57	19.67	7.3	4.0
Stoneville 825	1002	36.0	11.5	5.19	1.16	.57	18.35	6.3	4.6
Coker 310	998	35.6	11.6	5.73	1.19	.58	20.58	7.0	4.2
Stoneville 213	994	35.5	11.6	5.23	1.17	.58	18.96	8.0	4.7
DES 24	965	35.2	12.3	5.62	1.19	.59	20.03	7.5	4.6
Stoneville 256	963	35.7	10.5	5.23	1.17	.57	17.55	6.6	4.4
Coker 304	962	35.0	11.5	5.43	1.23	.59	20.54	6.4	4.2
Deltapine 55	957	36.9	10.0	4.99	1.17	.55	18.38	7.8	4.4
Stoneville 731N	949	36.5	10.9	4.99	1.15	.55	18.34	6.6	4.7
Paymaster 303	916	34.7	12.5	6.27	1.09	.54	18.83	6.8	4.6
Rex 713	821	31.8	13.1	6.04	1.15	.55	17.27	8.1	4.1
Acala SJ 5	800	35.5	12.4	5.91	1.21	.63	23.23	6.4	4.5
C.V.	5.8								
LSD .05	68								

Planted: April 18, 1978
Harvested: September 29, 1978

Table 2. Results of the 1978 Cotton Variety Test on a Dubbs sandy loam soil at Sumner, Miss.

	Lint per acre	Lint percent	Seed index	Boll size grams	Fiber Properties				
					Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire
McNair 235	1407	40.2	11.3	5.55	1.14	.59	18.69	7.6	5.1
Deltapine 26	1392	42.7	10.8	5.38	1.14	.58	19.72	8.4	5.4
Coker 310	1320	39.1	11.6	5.54	1.20	.59	19.53	7.6	4.5
Deltapine 7141	1288	43.4	9.8	5.49	1.14	.58	20.21	7.5	5.0
DES 56	1274	38.9	11.0	5.21	1.14	.57	19.02	8.4	4.8
DES 24	1260	38.9	11.9	5.46	1.17	.59	20.41	8.8	4.9
Stoneville 213	1256	39.5	11.3	5.60	1.11	.57	18.23	8.7	5.2
Deltapine 55	1249	41.0	10.2	5.27	1.16	.57	18.57	7.9	4.7
Stoneville 256	1238	39.7	11.7	5.58	1.16	.58	18.34	5.7	5.3
Stoneville 731N	1228	40.0	11.7	5.40	1.14	.57	18.76	7.3	5.4
Coker 315	1224	40.8	11.0	5.48	1.20	.60	19.81	8.3	4.8
Deltapine 61	1221	39.8	10.5	5.61	1.14	.58	19.00	10.5	5.0
Coker 304	1195	39.0	11.3	5.57	1.21	.60	19.96	7.7	4.5
Stoneville 825	1194	39.7	11.6	5.51	1.14	.58	18.31	7.3	5.5
Rex 713	1000	34.5	13.0	5.67	1.13	.55	16.66	8.5	4.4
C.V.	8.3								
LSD .05	119								

Planted: April 21, 1978
Harvested: October 6, 1978

Table 3. Results of the 1978 Cotton Variety Test on a Dundee sandy loam soil at Tunica, Miss.

	Lint Per Acre						Fiber Properties				
							Length				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
McNair 235	1110	951	86	39.5	10.8	5.29	1.15	.58	19.70	6.5	4.7
Deltapine 26	1106	882	80	42.1	10.6	5.27	1.12	.56	19.26	7.9	5.3
Deltapine 7141	1056	906	86	41.8	9.3	5.11	1.15	.57	19.75	7.7	4.5
Stoneville 213	1050	861	82	38.5	11.0	5.63	1.13	.57	18.71	7.6	5.2
DES 24	1049	897	86	38.8	11.6	5.71	1.16	.59	19.91	8.7	4.8
Deltapine 55	1028	888	86	40.0	10.7	5.13	1.15	.57	19.04	7.7	4.4
DES 56	1018	879	86	38.1	10.9	5.15	1.16	.59	19.77	7.9	4.8
Stoneville 825	1017	904	89	38.9	10.5	4.98	1.13	.56	18.68	6.3	4.8
Coker 304	1014	846	83	38.5	11.8	5.80	1.17	.58	21.58	6.8	4.7
Deltapine 61	1012	810	80	38.5	11.0	5.79	1.16	.60	21.10	9.9	5.0
Coker 310	999	829	83	38.0	11.8	6.22	1.19	.60	20.65	6.7	4.7
Coker 315	986	835	85	39.5	11.1	5.40	1.21	.60	21.17	8.3	4.7
Stoneville 731N	976	861	88	39.5	11.1	5.07	1.10	.54	17.64	6.3	4.7
Stoneville 256	927	761	82	39.2	10.6	5.22	1.12	.55	18.70	6.6	4.9
REX 713	885	757	85	36.1	12.0	6.11	1.12	.55	17.44	8.0	4.4
Paymaster 303	801	674	84	37.2	12.2	6.15	1.10	.55	19.12	7.0	4.4
Acala SJ-5	653	489	75	39.1	12.6	6.69	1.15	.61	22.62	7.1	4.7
C.V.	9.9										
LSD .05	117										

Planted: May 17, 1978
Harvested: October 11 and October 30, 1978

Table 4. Average performance of 15 cotton varieties grown in three Delta environments[1] in 1978.

					Fiber Properties				
					Length				
	Lint per acre	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
McNair 235	1214	38.9	11.2	5.39	1.15	.58	19.29	7.0	4.9
Deltapine 26	1178	40.9	10.5	5.15	1.14	.57	19.51	7.9	5.0
DES 56	1139	37.7	10.9	5.07	1.16	.58	19.31	8.2	4.6
Deltapine 7141	1121	41.1	9.4	5.09	1.15	.57	19.87	7.5	4.5
Coker 310	1106	37.6	11.7	5.83	1.19	.59	20.25	7.1	4.5
Stoneville 213	1100	36.9	11.3	5.49	1.14	.57	18.63	8.1	5.0
Deltapine 61	1096	38.1	10.7	5.60	1.16	.59	19.95	9.8	4.8
DES 24	1091	37.6	11.9	5.60	1.17	.59	20.12	8.3	4.8
Coker 315	1083	38.8	11.1	5.36	1.21	.60	20.17	8.0	4.6
Deltapine 55	1078	39.3	10.3	5.13	1.16	.56	18.66	7.8	4.5
Stoneville 825	1071	38.2	11.2	5.23	1.14	.57	18.44	6.6	5.0
Coker 304	1057	37.5	11.5	5.60	1.20	.59	20.69	7.0	4.5
Stoneville 731N	1051	38.7	11.2	5.15	1.13	.55	18.25	6.7	4.9
Stoneville 256	1043	38.2	10.9	5.34	1.15	.57	18.20	6.3	4.9
Rex 713	902	34.1	12.7	5.94	1.13	.55	17.12	8.2	4.3
C.V.	8.3								
LSD .05	60								

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[1] **Three environments - Stoneville, Tunica, Sumner.**

Table 5. Performance of eleven cotton varieties in seven Delta environments,[1] 1977-78 average.

	Lint per acre	Lint percent	Seed index	Boll size grams	Fiber Properties				
					Length		Strength g/tex	Elonga-tion	Micro-naire
					2.5%	50%			
Deltapine 26	1114	40.3	10.4	5.01	1.13	.55	19.55	7.4	4.9
DES 56	1099	37.2	11.0	4.89	1.16	.57	19.16	7.6	4.5
Stoneville 825	1081	37.8	11.4	5.07	1.14	.55	18.26	6.5	4.8
Coker 310	1080	37.2	11.6	5.73	1.20	.58	19.80	6.9	4.4
DES 24	1073	37.2	11.8	5.42	1.18	.57	20.31	8.0	4.7
Deltapine 55	1060	39.2	10.1	5.00	1.15	.55	18.63	7.6	4.4
Deltapine 61	1056	38.0	10.6	5.45	1.15	.57	19.83	9.2	4.8
Stoneville 213	1052	37.0	11.2	5.31	1.14	.56	18.44	7.8	4.8
Stoneville 713N	1046	38.1	11.3	5.01	1.13	.54	18.42	6.5	4.8
Stoneville 256	1041	37.8	11.2	5.23	1.15	.55	18.28	6.3	4.7
Coker 304	1016	37.5	11.6	5.38	1.20	.58	20.12	6.7	4.4

[1] Seven environments - Stoneville 3, Sumner 2, Tunica 2.

Table 6. Performance of nine cotton varieties grown in 13 Delta environments[1] 1975-1978 average.

	Lint Per Acre		Lint percent	Seed index	Boll size grams	Fiber Properties				
						Length		Strength g/tex	Elonga-tion	Micro-naire
	Total	Percent first pick				2.5%	50%			
DES 24	912	86	38.1	11.4	5.45	1.16	.56	20.28	8.0	4.6
DES 56	909	87	37.8	10.7	4.83	1.14	.56	19.34	7.5	4.5
Deltapine 55	885	85	40.0	9.8	5.02	1.14	.54	18.69	7.4	4.4
Stoneville 731N	882	86	39.0	10.9	4.95	1.12	.54	18.15	6.3	4.7
Stoneville 213	852	82	37.8	10.8	5.19	1.12	.55	18.69	7.7	4.8
Coker 310	852	84	38.0	11.3	5.53	1.19	.57	20.07	7.0	4.3
Deltapine 61	849	80	38.4	10.4	5.38	1.14	.56	19.81	9.0	4.7
Stoneville 256	847	82	38.2	10.9	5.16	1.14	.54	18.27	6.3	4.6
Coker 304	814	85	38.3	11.1	5.24	1.19	.57	20.16	6.7	4.4

[1] Thirteen environments - Stoneville 6, Tunica 4, Sumner 3.

Table 7. Results of the 1978 Cotton Variety Test on Leeper fine sandy loam soil at Mississippi State, Miss.

	Lint Per Acre				Fiber Properties				
					Length				
	Total	Percent open Sept. 8	Lint percent	Boll size grams	2.5%	50%	Strength g/tex	Elonga-tion	Micro-naire
Deltapine 7141	1257	19.7	42.9	5.30	1.18	.60	20.78	5.9	4.8
Deltapine 55	1253	17.5	41.1	5.36	1.18	.56	18.77	6.5	4.5
Stoneville 213	1218	27.6	40.4	5.77	1.17	.57	19.37	6.3	5.0
Stoneville 825	1204	25.0	40.6	5.57	1.16	.56	18.85	5.3	5.1
DES 56	1194	31.4	39.9	5.21	1.18	.57	19.30	6.1	4.8
Deltapine 61	1182	19.0	39.8	5.66	1.18	.57	19.89	6.9	5.1
Deltapine 26	1171	14.6	41.8	5.47	1.16	.55	20.12	5.6	5.3
Coker 310	1171	26.1	39.6	5.88	1.21	.58	20.44	5.2	4.7
Stoneville 256	1163	22.3	40.9	5.52	1.18	.56	18.92	5.0	5.2
Coker 315	1154	25.9	40.7	5.80	1.25	.59	20.49	5.4	4.9
Stoneville 731N	1143	18.4	40.5	5.67	1.17	.56	19.07	5.7	5.2
Coker 304	1080	26.5	40.2	5.96	1.23	.58	20.63	6.2	4.9
DES 24	1056	21.9	39.4	5.86	1.19	.58	19.74	6.3	4.9
REX 713	948	28.3	36.6	6.32	1.14	.52	17.23	6.7	4.5
C.V.	16.5		1.9	23.7					
LSD .05	80		0.88	0.27					

Planted: May 17, 1978
Harvested: October 17, 1978

Table 8. Results of the 1978 Cotton Variety Test on Catalpla silty clay loam soil at Verona, Miss.

				Fiber Properties				
				Length				
	Total lint per acre	Lint percent	Boll size grams	2.5%	50%	Strength g/tex	Elonga-tion	Micro-naire
Deltapine 26	580	42.3	4.28	1.10	.50	19.36	6.2	4.5
Deltapine 55	543	40.9	4.51	1.13	.50	18.85	5.9	4.0
Deltapine 7141	533	41.8	4.18	1.15	.51	19.67	5.5	3.7
Stoneville 213	530	39.5	5.31	1.14	.55	19.02	5.8	4.5
Stoneville 256	528	40.1	4.86	1.13	.51	17.98	5.0	4.3
Deltapine 61	510	39.9	4.73	1.13	.52	20.97	7.3	4.2
Coker 310	508	38.8	5.14	1.17	.54	19.33	5.4	3.8
Stoneville 731N	503	40.2	4.31	1.13	.49	19.18	5.1	4.2
Coker 304	483	39.4	5.63	1.17	.53	19.09	5.3	4.2
Stoneville 825	482	38.8	4.72	1.12	.50	17.96	5.0	4.0
DES 56	469	39.8	4.94	1.15	.55	19.31	5.9	4.1
Coker 315	460	39.4	5.47	1.18	.55	19.84	5.5	4.2
DES 24	430	39.2	5.28	1.14	.53	19.59	6.5	4.1
REX 713	422	36.4	5.84	1.10	.47	15.94	5.2	3.9
C.V.	13.9							
LSD .05	97							

Planted: May 17, 1978
Harvested: October 4, 1978

Table 9. Results of the 1978 Cotton Variety Test on a Grenada silt loam soil at Holly Springs, Miss.

	Lint Per Acre			
	Total	First pick	Percent first pick	Lint percent
Deltapine 55	991	528	53	39.9
Deltapine 26	962	419	44	41.4
DES 56	958	610	64	38.5
Coker 304	948	511	54	38.4
Stoneville 825	939	514	55	38.7
Coker 310	927	474	51	38.3
Stoneville 213	909	476	52	38.7
Deltapine 7141	902	454	50	41.4
DES 24	901	517	57	38.4
Deltapine 61	899	482	54	38.6
Stoneville 731N	893	515	58	39.3
Stoneville 256	884	434	49	39.1
Coker 315	832	436	52	39.1
REX 713	738	422	57	35.1
C.V.	8.7			
LSD .05	91			

Planted: May 11, 1978
Harvested: September 25 and October 17, 1978

Table 10. Performance of nine cotton varieties at Holly Springs, Miss. 1977-78 average.

	Lint Per Acre		
	Total	First pick	Percent first pick
DES 56	845	581	69
Deltapine 55	829	488	59
Stoneville 731N	822	508	62
Coker 304	806	498	62
DES 24	790	494	63
Stoneville 213	788	468	59
Coker 310	783	475	61
Stoneville 256	768	421	55
Deltapine 61	762	447	59

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Educational Aspirations And Achievements Of Rural And Small Town Mississippi Youth

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SUMMARY AND CONCLUSION

Educational aspirations of rural and small town sophomore high school students in two Mississippi counties in 1966 were found to be quite similar to those of youth studied in other sections of the United States. They aspired to relatively high educational levels; i.e., over 66% aspired to college or graduate degrees. Females had lower educational aspirations than did males, and whites had lower educational aspirations than did blacks. About 60% of the rural youth, but 75% of the city and town youth wanted to obtain a college degree.

Actual educational achievement fell below aspirations for the youth in this study. This is consistent with research being conducted in other parts of the country (Gasson, et al., 1972; Howell, 1978) and our findings on occupational aspirations and attainment (Sollie, et al., 1976) of Mississippi youth. However, educational achievement was measured only four years after a majority of the respondents had graduated from high school, and it still is possible for the aspiration-achievement differences to decrease.

Our findings indicate that educational aspirations play an important role in educational achievement in that higher aspiration levels are a necessary but not sufficient condition for high educational attainment. High educational aspirations are not a guarantee that a student will attain them, but very few students seem to achieve beyond their aspiration level.

This report is a limited study of the educational aspirations and achievements of some Mississippi youth and how these differ by sex, race, and place of residence. Further study is needed to document the educational experiences of Mississippi youth as they grow older. We will attempt to contact these same people in 1979.

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Educational Aspirations And Achievements Of Rural And Small Town Mississippi Youth

Providing some of their members with opportunities to obtain extensive formal education is vital for the functioning of industrialized societies. These societies also must provide rewards sufficient to assure an adequate supply of educated people. Industrialized societies generally offer higher incomes and more prestige to people in occupations requiring extensive education. Such rewards motivate parents to instill in their children the values of formal education.

Children become aware of the work world as they grow older (Osipow, 1973), begin to relate that world to their future plans and become increasingly realistic in matching their abilities and resources to their educational and occupational aspirations (Howell, et al., 1977). Also, many advancing students begin to value the aesthetic or personal satisfaction and growth potential of formal education.

The dual nature of education---preparing people for employment and the personal satisfaction derived from acquiring knowledge---makes it difficult to advise young people how much formal education they should seek. High school counselors can easily explain to students how much formal education they need to qualify for a particular job, but it becomes more difficult to describe the personal satisfaction in reaching a certain educational level.

Other factors that must be considered include the student's aspirations, expectations, abilities, motivation and financial situation. Counseling students effectively involves reducing disparities between these factors. For example, encouraging a student with a C average in high school and very little money to aspire to medical school would be unfair without providing a realistic assessment of the chances of reaching the goal and possible alternatives that may be more realistic. Therefore, it is important that vocational counselors know not only the talents and abilities of students with whom they work but also their educational choices.

We hypothesized that a student likely will not attain a high level of education without aspiring to do so, but that high aspirations do not guarantee high educational achievement. This publication reports the results of a study designed to test the validity of this hypothesis.

Tenth-grade students in Noxubee and Hancock Counties were interviewed in groups in 1966 to determine their educational aspirations. An attempt was made to interview the same students individually six years later to determine their educational achievements. However, only 134 interviews were completed in 1972 because 100 of the initial respondents could not be located with the time and resources available (Table 1). We present the data available on these 134 students with acknowledgement of possible bias due to selective sampling.

Table 1. Number of respondents interviewed in a survey to determine the educational aspirations and achievements of rural and small town youth, by race, sex and place of residence, Noxubee and Hancock Counties, Mississippi, 1969 and 1972.

	Non-Farm	Rural Farm	City or Town	Total
	----------	Number	----------	
Blacks				
Male	3	3	6	12
Female	4	9	6	19
Whites				
Male	16	20	21	57
Female	11	12	20	43
Total	34	44	53	131*

***Three students are omitted from this table because they failed to report their place of residence.**

EDUCATIONAL ASPIRATIONS

Students interviewed in 1966 were asked to list the type and level of education they would like to attain. Educational goals ranged from finishing high school to graduate studies (Table 2). More than 66.5% of the respondents aspired to a college or graduate degree. Slightly more than 20% of the students indicated an interest in vocational training, and 8.2% desired a junior college education. The remaining 5.2% wanted only to finish high school.

Educational Aspirations by Sex

A larger percentage of male than female students aspired to college or graduate degrees (Table 3). A greater percentage of females wanted vocational training. There were no male-female differences in the percent who aspired to a junior college education. The observation that male sophomore high school students had higher educational aspirations than did female students is consistent with findings from other parts of the country (Sewell and Shah, 1967; William, 1972).

Educational Aspirations by Race

Almost 76% of the black sophomore high school students wanted to obtain a college or graduate degree, and all black students wanted education beyond high school (Table 3). White sophomore students desired less education---6.9% did not plan to continue their education beyond high school, and 63.4% wanted to obtain a college or graduate degree. This finding that black sophomore students have higher educational aspirations was not unexpected (Carter, et al., 1972; Coleman, et al., 1966; Gordon, 1972; Porter, 1974, 1976; Hout and Morgan, 1975; Bachman, 1970; DeBord et al., 1977; Kerckoff and Campbell, 1977).

Educational Aspirations by Place of Residence

All rural non-farm students planned to continue their education beyond a high school degree, but 9.1% of the rural farm and 5.7% of the city or town students did not aspire to do so (Table 3). About 32% of the students in each rural category wanted a college degree compared to about 42% of the city or town students. A greater percentage of rural non-farm and rural farm residents desired vocational training than did city or town residents. About 60% of the students in each rural category aspired to a college or graduate degree, compared to 75% of city or town students.

EDUCATIONAL ACHIEVEMENTS

All students contacted in the follow-up interview in 1972 had planned to finish high school, but 12% had not done so four years after their high school class was graduated (Table 2). All but about 5% of the students planned to continue their education after high school; however, 45.5% had obtained no additional education four years after they got their diplomas. Fewer than one fourth of the sophomore high school students who aspired to a college or graduate degree had actually fulfilled their aspirations. More than one third of the students had aspired to a college degree but only 14.9% had attained this educational level in 1972.[1]

Differences between aspirations and achievements were not large at the junior college and vocational training level (Table 2). Occurrence of the largest discrepancies between aspirations and achievements were at the lower and higher educational levels.

Numbers of students who achieved their educational aspirations were 0, 1, 3, 0, 13 and 0, respectively, for some high school, finished high school, vocational training, junior college, college degree and graduate degree. Only five of the 134 students had attained educational levels higher than their expectations. Underachievers numbered 112 or 83.6% of the sample and were most heavily concentrated in the higher educational aspiration levels.

Educational Achievements by Sex, Race and Residence

Major differences in male and female educational attainments were in the high school and vocational training categories (Table 4). About 7% of the males and 18% of the females had not completed high school by 1972. Only 9.7% of the females but 18.1% of the males had received vocational training.

The difference was small, but more females than males had a college degree by 1972. However, only 30.6% of the females had aspired to a college degree but 41.7% of the males had expressed aspiration for

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[1] Some of the respondents may still have been working on college degrees four years after high school. Some who were not in school in 1972 may eventually resume their education.

this level of education (Table 3). These findings are consistent with those of other researchers who have found that females are less likely to aspire to a college degree (Sewell and Shah, 1967). However, when females attend college their gender does not affect their chances of graduating (Sewell and Shah, 1967, 1968; Alexander and Eckland, 1974).

Differences in achievement by blacks and whites were largest for the high school diploma and college degree categories. This finding also is consistent with the literature (Duncan, 1967; Jencks et al., 1973; Portes and Wilson, 1976). A college degree had been obtained by 17.8% of the white students, but only 6.1% of the blacks had reached this level by 1972.

Place of residence had little effect on educational attainment and this is consistent with results of a study of Wisconsin youth (Sewell, et al., 1970). The major exception was that only about 6% of the rural non-farm residents received junior college degrees, while about 15% of both rural farm and city or town residents did.

Table 2. Educational aspirations in 1966 and educational achievements in 1972, 134 rural and small town youth, Noxubee and Hancock Counties, Mississippi.

	1966 Aspirations		1972 Achievements	
Education	Number	Percent	Number	Percent
Some High School	0	0.0	16	12.0
Finish High School only	7	5.2	61	45.5
Vocational Training (with or without H.S. Degree)*	27	20.1	19	14.2
Junior College**	11	8.2	18	13.4
College Degree	49	36.6	20	14.9
Graduate Degree***	40	29.9	0	0.0
Total	134	100.0	134	100.0

***Includes practical nursing and military training**

****Includes business school**

*****It is not likely that there had been sufficient time for any respondents to receive a graduate degree by 1972.**

Table 3. Educational aspirations of 134 rural and small town youth by sex, race and place of residence, Noxubee and Hancock Counties, Mississippi, 1966.

					Place of Residence*		
Educational	Sex		Race		Rural Non-	Rural	City or
Aspiration	Males	Females	Blacks	Whites	Farm	Farm	Town
	Percent						
Finish High School only	2.8	8.1	0.0	6.9	0.0	9.1	5.7
Vocational Training (with or without H.S. degree)	12.5	29.0	18.2	20.8	29.4	25.0	11.3
Junior College	8.3	8.1	6.1	8.9	8.8	6.8	7.5
College Degree	41.7	30.6	24.2	40.6	32.4	31.8	41.5
Graduate Degree	34.7	24.2	51.5	22.8	29.4	27.3	34.0
Totals (%)	100.00	100.00	100.00	100.0	100.0	100.0	100.0
No	72	62	33	101	34	44	53

***The number of cases for place of residence totals 131 because three of the respondents did not provide this information.**

Table 4. Educational achievements of 134 rural and small town youth by sex, race and place of residence, Noxubee and Hancock Counties, Mississippi, 1972.

Educational Achievement	Sex		Race		Place of Residence[1]		
	Males	Females	Blacks	Whites	Rural Non-Farm	Rural Farm	City or Town
	Percentage						
Some High School	6.9	17.8	15.1	10.9	14.7	11.4	9.4
Finish High School	47.2	43.5	51.5	43.6	50.0	45.5	43.4
Vocational Training (with or without a H.S. Degree)*	18.1	9.7	18.2	12.9	14.7	13.6	15.1
Junior College**	13.9	12.9	9.1	14.8	5.9	15.9	15.1
College Degree	13.9	16.1	6.1	17.8	14.7	13.6	17.0
Graduate Degree***	---	--	---	---	---	---	--
Totals (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No.	72	62	33	101	34	44	53

[1] Totals to 131 because 3 respondents did not provide this information

***Includes practical nursing and military training**

****Includes business school**

*****It is not likely that there had been sufficient time for any respondents to receive a graduate degree by 1972.**

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Germplasm Release of 81 F_5 Flowering Lines of Cotton Involving 54 *Gossypium hirsutum* L. Race Accessions

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Germplasm Release of 81 F_5 Flowering Lines of Cotton Involving 54 *Gossypium hirsutum* L. Race Accessions

We have released 81 non-commercial lines of cotton, *Gossypium hirsutum* L, containing germplasm from 54 of the primitive accessions in the race collection maintained at Texas A&M University under Regional Project S-77. Each of the 81 releases contains flowering germplasm of the primitive races (Table 1), but the 81 releases also represent a pool of genetic diversity because of the breeding procedure employed. The 54 accessions were crossed as males with either 'Deltapine 16' (DPL-16) or Lubbock Dwarf---27 with Lubbock Dwarf and DPL-16, two with Lubbock Dwarf only, and 25 with DPL-16 only.

The procedure for developing the flowering lines was to cross males of each race accession to the upland parent at the winter nursery at Iguala, Mexico. The F_1 generation was self-pollinated at the winter nursery in Iguala, and the F_2 generation was grown in the field at Mississippi State University. Only those plants with the first fruiting branch at node 10 or below were kept in the crosses with Lubbock Dwarf as the female, and only those plants with the first fruiting branch at node 13 or below were kept in the crosses with DPL-16 as the female. Open-pollinated seed were harvested from each F_3 progeny row that produced bolls, and most rows produced significant amounts of mature seed. Equal numbers of seed from each F_3 row were pooled and planted for the F_4 generation. Open-pollinated seed from the F_4 generation were harvested, and the F_5 seed are available for release. We have purposely maintained genetic diversity by selecting only for node of first fruiting branch.

The primitive race parents were evaluated in the field for resistance to natural infestations of *Cercospora gossypina* and *Verticillium dalhia*. Reaction to *Cercospora* was rated on a scale of 1 (most resistant) to 5 (most susceptible). *Verticillium* wilt reaction ratings were made from visual observations of leaf symptoms, and lines were rated as having no symptoms, moderate symptoms or severe symptoms (Table 1). We are releasing F_5 flowering segregates from 20 lines that rated 3 or less for *Cercospora* and 21 lines that were scored as R for Verticillium wilt. Nine were common to both groups.

Crosses involving 18 of the 54 race accessions had significantly lower boll weevil oviposition than did the 'Stoneville 213' check in no-choice oviposition tests with the F_4 generation in 1977 (Table 2). Two of the 18 were crossed with Lubbock Dwarf and DPL-16, 10 with Lubbock Dwarf only, and six with DPL-16 only.

None of the 81 strains demonstrated resistance to bollworm as measured by growth rate of bollworm larvae from emergence to five days on abscised terminal leaves from F_4 lines.

Small amounts (200) of seed of these stocks are available for distribution to cotton breeders and other researchers as long as supplies last. Requests should be addressed as follows:

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Table 1. Breeding, Fruiting Habits, and Disease Resistance of the F_4 Generation of 81 Non-Commercial Lines of Cotton, *Gossypium hirsutum* L., Containing Germplasm from 54 Primitive Races of Cotton.

	S-77			F_2 Population		Reaction of Parental Race to:	
Line[1]	Accession No.[2]	Race[3]	Female Parent[4]	With squares	Selected[5]	Cercospora gossypina[6]	Verticillium wilt[7]
				-------%-------			
JPM-781-185-1	185	1	1	2.7	1.3	5	R
JPM-781-185-2	185		2	25.6	1.6		
JPM-782-26-1	26	2	1	16.5	10.4	3	S
JPM-782-26-2	26		2	49.1	12.7		
JPM-782-94-1	94	2	1	26.3	18.1	2	R
JPM-782-94-2	94		2	47.4	12.3		

(Continued)

Table 1. (Continued)

	S-77			F_2 Population		Reaction of Parental Race to:	
Line[1]	Accession No.[2]	Race[3]	Female Parent[4]	With squares	Selected[5]	Cercospora gossypina[6]	Verticillium wilt[7]
				-------%-------			
JPM-786-11-1	11	6	1	14.0	8.6	3	S
JPM-786-11-2	11		2	2.1	0.3		
JPM-786-194-1	194	6	1	36.5	9.9	3	S
JPM-786-194-2	194		2	9.8	1.1		
JPM-786-292-1	292	6	1	22.0	3.0	2	S
JPM-786-292-2	292		2	6.5	0.6		
JPM-786-295-1	295	6	1	6.8	2.9	3	R
JPM-786-295-2	295		2	40.7	6.4		
JPM-786-297-1	297	6	1	8.6	8.0	---	---
JPM-786-297-2	297		2	21.2	3.3		
JPM-784-336-1	336	4	1	10.7	1.6	5	R
JPM-784-336-2	336		2	9.5	0.4		
JPM-788-339-1	339	8	1	8.8	1.1	5	R
JPM-788-339-2	339		2	13.6	0.1		
JPM-788-404-1	404	8	1	82.3	56.1	---	---
JPM-788-404-2	404		2	95.3	74.9		
JPM-788-459-1	459	8	1	26.0	16.1	2	R
JPM-788-459-2	459		2	4.7	0.4		
JPM-788-679-1	679	8	1	48.6	28.8	2	R
JPM-788-679-2	679		2	29.5	14.6		
JPM-788-730-1	730	8	1	13.6	3.6	---	---
JPM-788-730-2	730		2	8.4	1.1		
JPM-788-732-1	732	8	1	6.9	1.0	4	S
JPM-788-732-2	732		2	19.5	4.0		
JPM-788-759-1	759	8	1	26.5	19.0	2	S
JPM-788-759-2	759		2	86.1	22.9		
JPM-788-763-1	763	8	1	78.4	43.9	3	S
JPM-788-763-2	763		2	80.4	26.2		
JPM-788-766-1	766	8	1	18.9	9.6	1	R
JPM-788-766-2	766		2	11.0	1.7		
JPM-788-786-1	786	8	1	21.9	7.7	4	R
JPM-788-786-2	786		2	15.5	3.9		
JPM-788-790-1	790	8	1	7.0	2.4	2	R
JPM-788-790-2	790		2	17.7	3.8		
JPM-788-805-1	805	8	1	17.3	9.2	4	S
JPM-788-805-2	805		2	22.1	5.9		
JPM-788-1134-1	1134	8	1	17.0	4.0	5	S
JPM-788-1134-2	1134		2	7.4	0.5		
JPM-788-1149-1	1149	8	1	52.7	34.3	---	---
JPM-788-1149-2	1149		2	62.1	15.5		
JPM-788-1159-1	1159	8	1	27.9	9.9	4	R
JPM-788-1159-2	1159		2	20.7	2.0		
JPM-788-1167-1	1167	8	1	42.7	18.9	---	---
JPM-788-1167-2	1167		2	22.6	4.0		
JPM-788-1177-1	1177	8	1	7.5	2.1	4	R
JPM-788-1177-2	1177		2	19.2	2.1		

(Continued)

Table 1. (Continued)

	S-77			F_2 Population		Reaction of Parental Race to:	
Line[1]	Accession No.[2]	Race[3]	Female Parent[4]	With squares	Selected[5]	Cercospora gossypina[6]	Verticillium wilt[7]
				-------%	-------		
JPM-788-1180-1	1180	8	1	47.5	17.3	---	---
JPM-788-1180-2	1180		2	54.5	9.0		
JPM-784-347-2	347	4	2	25.2	1.7	---	---
JPM-782-1045-2	1045	2	2	20.8	1.2	---	---
JPM-788-267-1	267	8	1	9.6	2.9	---	---
JPM-784-326-1	326	4	1	10.7	1.2	5	R
JPM-788-725-1	725	8	1	15.3	5.6	2	R
JPM-788-764-1	764	8	1	49.5	20.6	3	VS
JPM-781-3-1	3	1	1	88.2	50.9	3	S
JPM-781-59-1	59	1	1	76.7	39.3	4	S
JPM-781-66-1	66	1	1	65.7	40.0	3	VS
JPM-781-69-1	69	1	1	78.4	30.3	5	S
JPM-781-75-1	75	1	1	54.3	18.4	5	S
JPM-781-78-1	78	1	1	25.7	9.8	5	S
JPM-781-84-1	84	1	1	55.1	30.2	5	R
JPM-781-88-1	88	1	1	53.6	29.5	4	S
JPM-781-103-1	103	1	1	55.5	36.5	---	---
JPM-781-106-1	106	1	1	54.6	37.0	1	R
JPM-781-109-1	109	1	1	78.1	45.7	---	---
JPM-781-113-1	113	1	1	77.3	58.2	5	R
JPM-781-118-1	118	1	1	17.1	8.4	---	---
JPM-781-159-1	159	1	1	18.2	4.1	---	---
JPM-781-201-1	201	1	1	31.9	18.0	5	R
JPM-781-209-1	209	1	1	27.0	14.2	5	R
JPM-781-223-1	223	1	1	28.2	10.6	5	R
JPM-782-25-1	25	2	1	21.4	8.8	3	VS
JPM-782-488-1	488	2	1	63.7	27.4	---	---
JPM-782-495-1	495	2	1	16.3	5.5	2	R
JPM-785-461-1	461	5	1	62.8	16.9	3	S

[1] Explanation of Code; e.g., JPM-781-185-1: JPM = originators; 78 = year of germplasm release; 1 through 8 = race designation (1 = latifolium, 2 = punctatum, 3 = marie-galante, 4 = palmeri, 5 = richmondi, 6 = morrilli, 7 = yucatanense, and 8 = unclassified); 185 = accession number in ARS catalogue ARS-H-2, October 1974, the regional collection of *Gossypium* germplasm, and 1 = serial release number from crosses involving this particular accession.

[2] Accession numbers are Texas numbers from the regional collection of *Gossypium* germplasm, ARS-H-2, October 1974.

[3] Race Code 1 = latifolium; 2 = punctatum; 3 = marie-galante; 4 = palmeri; 5 = richmondi; 6 = morrilli; 7 = yucatanese; 8 = unknown.

[4] Female parent 1 was DPL-16; Female parent 2 was Lubbock Dwarf.

[5] In the F_2 with DPL-16 all plants with first fruiting branch at node 13 or below were kept. In the Lubbock Dwarf cross all plants with first fruiting branch at node 10 or below were kept.

[6] *Cercospora* ratings 1 - 3 = Resistant, 4 - 5 = Susceptible.

[7] R = no leaf symptoms, S = moderate leaf symptoms, VS = severe leaf symptoms.

Table 2. Boll Size, Fiber Properties, and Insect Resistance of the F_4 Generation of 81 Non-Commercial Lines of Cotton, *Gossypium hirsutum* L., Containing Germplasm from 54 Primitive Races of Cotton.

		F_4 Bulk Progeny Boll and Fiber Properties						Boll weevil	Weight of 5-day-old Heliothis
Line[1]	Boll Size	Lint	50% SL	2.5% SL	El	Tl	Micronaire	eggs/female/ day[2,3]	virescens larvae[3]
	g	%			%	g/Tex		no	mg
JPM-781-185-1	5.3	33.0	.59	1.21	6.7	20.6	4.9	13.0	12.8
JPM-781-185-2	4.3	28.9	.58	1.21	7.5	23.2	4.7	15.6	15.4
JPM-782-26-1	5.4	32.9	.58	1.23	6.5	23.0	4.7	17.8	18.5
JPM-782-26-2	4.5	28.7	.59	1.24	6.0	21.9	4.5	16.7	20.6
JPM-782-94-1	4.8	30.8	.55	1.17	7.3	22.5	4.6	11.0**	15.6
JPM-782-94-2	4.7	31.8	.54	1.13	6.5	21.7	4.7	17.2	20.7
JPM-786-11-1	5.0	30.4	.57	1.17	6.5	22.3	4.9	13.1	13.7
JPM-786-11-2	4.8	34.4	.56	1.16	7.0	21.6	4.6	13.6	22.2 z
JPM-786-194-1	5.4	32.5	.56	1.21	6.8	22.1	4.4	14.1	12.9
JPM-786-194-2	4.7	29.1	.57	1.18	7.0	23.0	4.4	15.4	18.9
JPM-786-292-1	4.8	31.0	.54	1.19	6.8	19.9	4.3	13.4	10.9
JPM-786-292-2	4.6	30.3	.56	1.17	7.0	23.0	4.3	14.3	19.5
JPM-786-295-1	5.2	32.8	.57	1.18	6.5	21.0	4.8	14.7	12.4
JPM-786-295-2	4.7	33.4	.56	1.15	6.3	20.3	4.7	13.2	22.0 z
JPM-786-297-1	5.6	35.4	.60	1.26	6.5	21.9	4.5	14.0	16.6
JPM-786-297-2	4.2	32.7	.52	1.11	6.5	19.2	4.4	12.6**	26.1 z
JPM-784-336-1	5.1	32.7	.60	1.23	7.0	21.6	4.6	12.2*	16.1
JPM-784-336-2	4.4	34.8	.55	1.14	7.0	21.4	5.1	12.0**	15.8
JPM-788-339-1	4.9	32.1	.55	1.20	6.8	22.0	4.3	11.9**	13.6
JPM-788-339-2	4.5	32.2	.55	1.13	6.5	21.9	4.9	11.0*	17.3
JPM-788-404-1	5.4	33.0	.49	1.09	6.8	18.7	4.3	12.1	30.3 z
JPM-788-404-2	4.2	32.6	.51	1.07	5.3	22.8	4.1	14.6	38.9 z
JPM-788-459-1	5.5	37.3	.57	1.21	7.5	21.5	5.1	13.7	13.7
JPM-788-459-2	3.6	28.0	.54	1.03	7.0	23.2	4.1	13.2**	30.9 z
JPM-788-679-1	5.3	30.6	.59	1.15	6.8	24.0	5.1	13.3	14.1
JPM-788-679-2	3.8	27.9	.50	1.08	6.0	20.9	4.2	15.2	18.7
JPM-788-730-1	4.9	31.4	.57	1.23	7.5	21.2	5.0	14.2	15.0
JPM-788-730-2	5.1	30.2	.59	1.19	6.0	22.7	4.9	11.4*	14.4
JPM-788-732-1	4.8	29.8	.56	1.22	7.3	23.0	4.7	14.9	14.2
JPM-788-732-2	5.3	31.5	.57	1.18	5.8	24.5	4.8	14.1	19.6
JPM-788-759-1	5.0	33.7	.54	1.12	5.8	22.0	4.7	14.5	17.6
JPM-788-759-2	4.0	31.1	.49	1.03	5.8	22.2	4.4	14.6	23.4 z
JPM-788-763-1	5.0	34.6	.56	1.15	7.8	21.3	4.9	13.6	20.5
JPM-788-763-2	4.6	29.1	.58	1.17	6.5	24.5	4.5	14.5	18.5
JPM-788-766-1	5.5	33.4	.58	1.23	7.5	21.7	4.9	13.7	15.0
JPM-788-766-2	4.4	28.7	.54	1.13	6.8	21.4	4.5	13.2**	14.6
JPM-788-786-1	4.8	31.6	.57	1.18	6.8	23.2	4.8	14.0	16.1
JPM-788-786-2	4.6	28.5	.54	1.10	7.5	20.6	4.2	13.7	17.9
JPM-788-790-1	4.6	31.1	.56	1.13	6.8	21.6	4.5	13.9	15.8
JPM-788-790-2	4.6	29.0	.55	1.10	6.5	22.7	4.8	11.8*	17.8
JPM-788-805-1	4.9	35.2	.55	1.14	6.8	21.2	4.8	12.2	16.3
JPM-788-805-2	4.3	30.9	.55	1.11	7.5	22.2	4.5	9.8*	20.6

(Continued)

Table 2. (Continued)

JPM-788-1134-1	4.5	34.2	.53	1.14	7.5	22.9	4.9	13.1	13.1
JPM-788-1134-2	4.7	30.0	.53	1.07	7.5	20.6	4.5	14.6	17.8
JPM-788-1149-1	4.4	33.2	.55	1.11	8.0	20.8	4.8	14.0	15.3
JPM-788-1149-2	4.2	30.0	.55	1.13	6.3	23.2	4.3	14.6	19.0
JPM-788-1159-1	4.7	31.0	.57	1.18	7.3	21.2	4.4	12.9	20.3 z
JPM-788-1159-2	5.6	28.2	.57	1.19	7.0	21.4	4.4	16.6	16.4
JPM-788-1167-1	5.2	30.3	.57	1.19	6.5	22.9	4.7	13.6	27.5 z
JPM-788-1167-2	5.0	29.3	.55	1.12	6.8	20.6	5.4	13.3**	16.4
JPM-788-1177-1	3.9	30.8	.57	1.16	6.5	21.8	4.8	13.7	18.5 z
JPM-788-1177-2	3.2	33.3	.56	1.15	7.0	20.8	4.6	12.1**	11.9
JPM-788-1180-1	4.0	31.9	.54	1.18	7.5	21.9	4.8	13.1	18.1
JPM-788-1180-2	3.9	32.5	.55	1.12	7.5	20.8	4.6	11.6*	17.1
JPM-784-347-2	4.5	31.1	.57	1.18	6.0	22.0	4.7	11.2**	17.0
JPM-782-1045-2	4.7	28.4	.54	1.09	6.3	22.4	5.0	15.4	17.6
JPM-788-267-1	6.2	33.2	.58	1.21	7.3	23.8	4.6	13.1	12.6
JPM-784-326-1	4.8	33.0	.56	1.19	8.0	22.5	4.7	12.2	13.3
JPM-788-725-1	4.7	34.0	.55	1.14	6.8	22.7	4.9	11.2**	15.5
JPM-788-764-1	4.9	31.9	.60	1.22	7.8	21.5	4.9	14.3	15.1
JPM-781-3-1	5.9	33.9	.57	1.16	7.8	21.1	5.4	12.6	14.4
JPM-781-59-1	5.1	30.9	.58	1.21	6.5	20.8	4.8	13.6	16.9
JPM-781-66-1	5.7	31.3	.58	1.18	6.0	24.8	5.1	12.8	14.9
JPM-781-69-1	4.9	31.4	.57	1.14	7.5	22.4	4.7	12.7	19.9
JPM-781-75-1	4.8	31.5	.56	1.14	7.5	23.9	5.1	14.2	16.3
JPM-781-78-1	4.1	32.5	.55	1.13	7.0	23.7	4.7	13.1	19.0
JPM-781-84-1	4.9	32.0	.60	1.22	7.3	22.6	4.6	12.8	17.5
JPM-781-88-1	5.9	30.9	.58	1.22	7.0	22.4	4.9	12.4	13.8
JPM-781-103-1	5.7	32.6	.58	1.20	6.0	22.6	4.7	13.9	17.1
JPM-781-106-1	4.8	29.9	.58	1.17	5.5	20.8	5.1	12.2	15.9
JPM-781-109-1	5.6	32.3	.58	1.16	6.5	22.6	5.1	12.3	13.8
JPM-781-113-1	5.0	33.4	.56	1.14	7.3	20.4	4.9	11.9**	16.0
JPM-781-118-1	6.0	35.6	.57	1.22	7.3	22.4	4.6	11.7**	12.6
JPM-781-159-1	4.9	34.1	.56	1.18	7.5	20.9	4.9	11.5**	12.2
JPM-781-201-1	5.9	30.8	.59	1.22	7.3	22.4	5.0	13.2	13.5
JPM-781-209-1	5.3	31.0	.62	1.26	7.0	22.8	4.5	12.7	15.9
JPM-781-223-1	4.9	31.1	.58	1.17	6.8	21.2	4.9	13.4	15.2
JPM-782-25-1	4.9	28.4	.61	1.22	6.8	23.0	5.1	11.2**	16.3
JPM-782-488-1	4.9	34.0	.59	1.20	7.8	22.7	5.0	15.2	13.1
JPM-782-495-1	5.3	36.2	.61	1.23	8.5	21.5	5.0	13.5	16.6
JPM-785-461-1	5.2	32.6	.57	1.15	7.0	23.1	4.9	13.4	16.3

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[1] See Footnote 1, Table 1.

[2] Significantly fewer eggs than on ST-213 at * 0.10 level and ** 0.05 level.

[3] All crosses with DPL-16 were in Test 1. Boll weevil eggs: DPL-16 = 11.6, ST-213 = 13.9. Bollworm weight: DPL-16 = 13.1; ST-213 = 7.9. All crosses with Lubbock Dwarf were in Test 2. Boll weevil eggs: DPL-16 = 14.4; ST-213 = 15.0. Bollworm weight: DPL-16 = 12.8; ST-213 = 11.1. All data collected on F_4 bulk progeny.

z = larvae significantly larger than on DPL-16 at 0.05 level. All data collected on F_4 bulk progeny.

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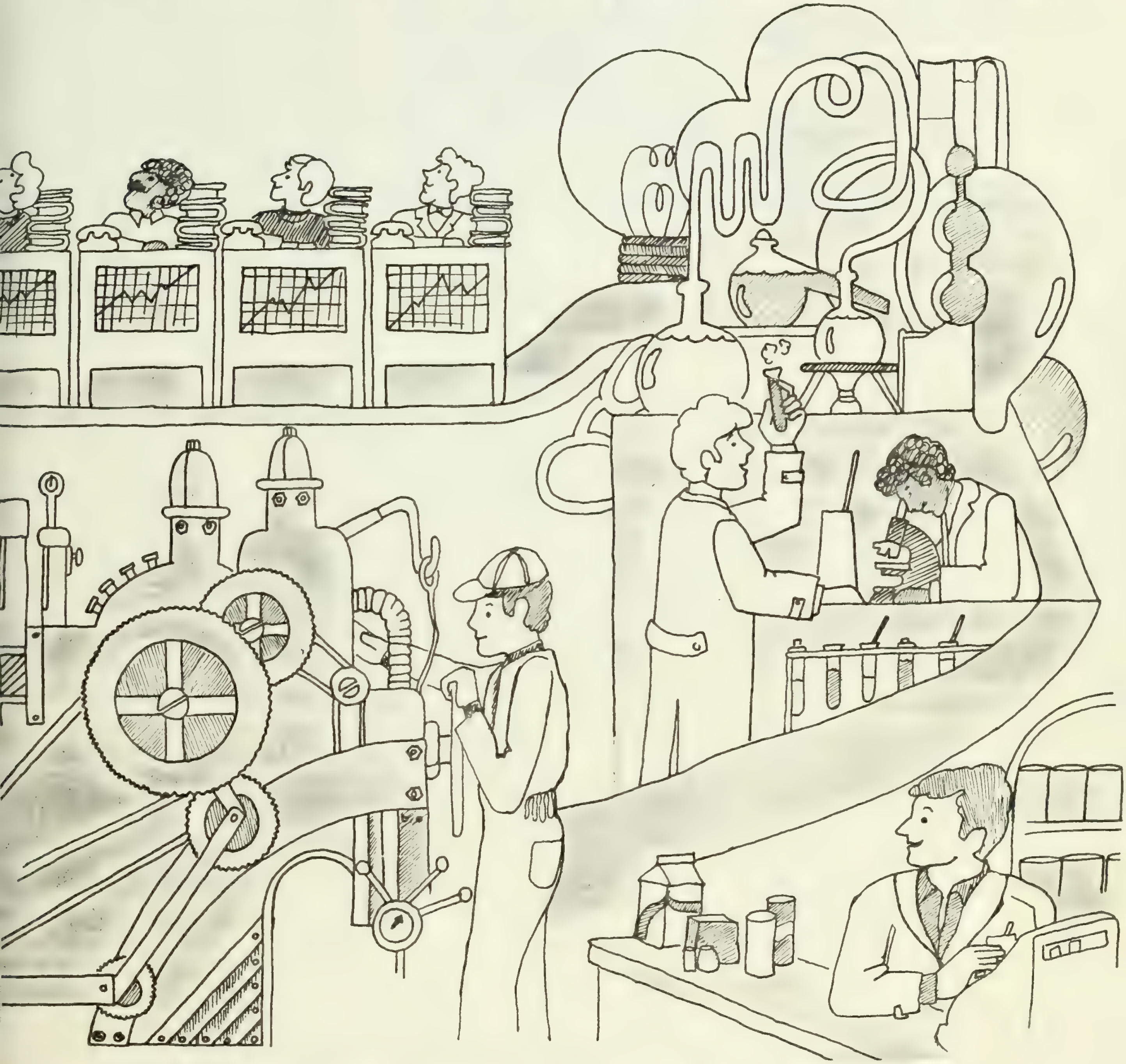
Bulletin 882 November 1979

Occupational Knowledge And The Vocational Aspirations And Expectations Of Southern Non-Metropolitan Male Youth



By Wolfgang Frese, Carlton R. Sollie and Frank M. Howell

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PREFACE

This bulletin is directed at high school educators with the hope hat a better understanding of the role that occupational knowledge plays in determining vocational aspirations and expectations will aid them in their counseling endeavors. The results presented in this publication are taken from a technical article on occupational knowledge based on data from the Southern Regional Project S-81. Due to the nature of the article, we felt it appropriate to present our findings in a less technical format. Copies of the technical paper entitled "Ginzberg's Theory of Occupational Choice: A Reanalysis of Increasing Realism" may be obtained by writing the authors at the following address:

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November, 1979

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Occupational Knowledge and the Vocational Aspirations and Expectations of Southern Non-Metropolitan Male Youth

popular notion among educa- and social scientists interested ccupational aspirations and ex- tations is that knowledge about dynamics of the labor force cture and the rewards and re- ements that accompany vari- occupations are important fac- which high school students e into consideration when for- ating their occupational goals. s bulletin explores the role of h occupational knowledge in ermining vocational aspira- s and expectations of Southern -metropolitan youth.

ata for this report are from a longitudinal study of non-metropolitan youth in six Southern states.[1] The sample design was purposive in nature, emphasizing variation in socioeconomic characteristics of selected counties in participating states.[2]

While the respondents, strictly speaking, are not representative of a larger population, they are stratified by race and sex and do afford an appropriate research design for analyzing changes in occupational attitudes and attainment. Data analyzed in this report are from a subset of respondents from whom appropriate data were collected in both 1966 and 1968. We limited this study to males, yielding a sample of 367 high school students of whom 221 are white and 146 non-white (more than 94% of the non-whites are black).

The 1966 and 1968 data were gathered via group-administered standardized questionnaires in the 10th and 12th grades, respectively. Those respondents who had dropped out of school or who had moved by 1968 were recontacted via personal interview and/or a mail questionnaire.

NZBERG'S THEORY OF OCCUPATIONAL CHOICE

he hypothetical perspective for research report is derived from zberg's theory of occupational ce.[3] The primary focus here is the impact of occupational wledge on male high school ents' occupational aspirations expectations. Ginzberg's posi- is that occupational choices as mediators between a stu- 's background or socioeconom- status and his occupational rations and expectations while in high school. The term "occupational choice" is used here to imply an inclination toward a certain occupation, not an occupation (or goal) actually chosen to be embarked upon immediately.

Regardless of the particular application of Ginzberg's theory, an underlying central theme is the increasing rationality involved in the individual's occupational choice. The process is viewed as a number of compromises between occupational aspirations and expectations. An adolescent's occupational aspiration refers to his occupational desire if he were free to choose any occupation he wished, while his occupational expectation refers to the occupation he actually expects to attain. This process becomes important in what Ginzberg has termed the "tentative period" in adolescent development (11-18 years of age). At this age the adolescent starts to recognize the

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The data used in this bulletin are from the S-81 Regional Project, "Development of Human Resource Poten- of Rural Youth in the South and Their Patterns of Mobility," sponsored by the USDA (CSRS) and carried out e Agricultural Experiment Stations of Alabama, Georgia, Louisiana, Mississippi, South Carolina and s.

or a more detailed discussion of the sampling procedures for the S-81 project see George W. Ohlendorf "The ation Status Attainment Process of Rural Males in the South," Unpublished doctoral dissertation, College n, Texas: Texas A & M University, 1973.

E. Ginzberg, S.W. Ginzburg, S. Axelrad, J.L. Herma, Occupational Choice, New York: Columbia Press, 1951.

actors involved in attaining uture occupational desires. In adlition, the individual's perception f the lifestyle accompanying his ccupational choice becomes inreasingly important. Heightened wareness of the work world is the ornerstone of developing rationalty that functions to shift fantasy esires (or aspirations) into realisic choices (or expectations).

Other researchers suggest that mportant areas within this perspective include the differential socialization of the adolescent (which determines occupational role perceptions) and his perception of obstacles or blocks which limit his desired occupational choices. For instance, the adolescent may perceive a lack of parental interest, lack of money, the absence of a nearby technical school or college, or his own reluctance to move.[4] If he thinks obstacles are too great, the adolescent's occupational goals will be lowered. However, research on this process of increasing realism has yielded mixed results. For example, while O'Hara and Tiedeman[5] found some support for vocational clarification and the existence of developmental stages, O'Hara[6] concluded that such stages were not clearly marked in the time span outlined by Ginzberg and colleagues. This report sheds additional light on these mixed findings.

URPOSE

Awareness of the work world nd its structure; i.e., occupational nowledge, as a factor in the choice rocess is primarily a contribution f developmental theory. The conept, however, has encountered difculty in finding its way into reearch on occupational choice proesses. This report focuses on the ole of occupational knowledge as relates to the vocational orientaons of Southern non-metroolitan high school males, their erceptions of reality, and the efcts of these attitudes on their uture plans. The objective is to ssess empirically a model develbed from Ginzberg's framework that depicts the process of increasing realism in occupational choice attitudes. The empirical accuracy of this theoretical model (Figure 1) was tested to see to what extent our data support increasingly realistic occupational choices among Southern non-metropolitan high school males.

In the model (Figure 1), occupational knowledge has two separate dimensions (awareness of occupational roles and knowledge of the current state of the labor force)[7], both tending to influence a student's perception of reality factors or goal blockages. The level of these perceived goal blockages is the individual's awareness of the social contingencies involved in maintenance of the present level of aspiration.[8] Level of perceived goal blockage is thus a key intervening variable between occupational aspirations and expectations. That is, this theoretical model of the realism approach posits that individuals modify their expectations for future occupational attainment on the basis of their occupational aspirations, perceived goal blockages, occupational knowledge and social origin (background).

Figure 1 indicates the time sequence and the major causal influences of the variables in the

[4] *For a complete list of items used in this study see footnote 8.*

[5] *O'Hara, R.P. and D.V. Teideman "Vocational Self Concept in Adolescence," Journal of Counseling ychology,* Vol. 6, 1959, pp. 292-301.

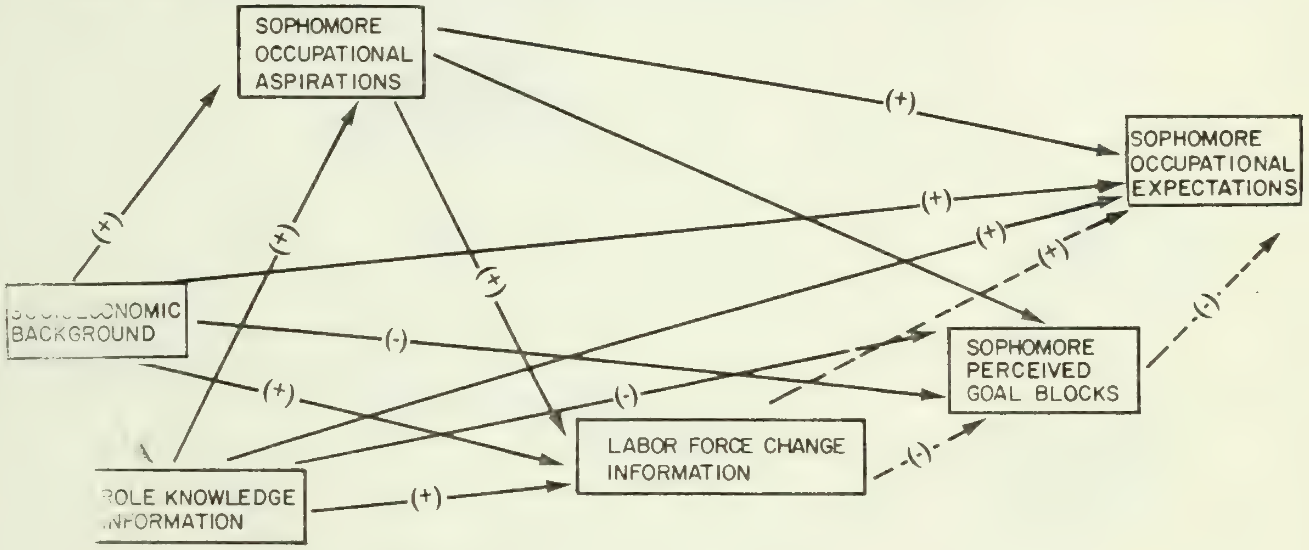
[6] *O'Hara, R.P. "Talks About Self---the Results of a Pilot Series of Interviews in Relation to Ginzberg's Theory)ccupational Choice," Harvard Studies in Career Development* No. 14, Center for Research in Career, Harvard aduate School of Education, Cambridge, Mass., October 1959.

[7] *Occupational role knowledge was measured by the summed score of two questions which ascertained the reondent's knowledge of occupational role rewards and requirements. Labor force change knowledge was meaed by the summed score of three questions dealing with the respondent's awareness of the dynamic shifts in labor force. The questions dealt with current changes in industries, jobs and unemployment.*

[8] *Perceived goal blocks were measured using the summed score of ten items (lack of parental interest, schools viously attended, not enough money to attend technical school or college, race, not wanting to move, national rcity of good jobs, local scarcity of good jobs, no technical school or college nearby, lack of information about sting opportunities, personal intelligence) which the respondents were asked to rank on a four-point continuum m "not at all" to "very much" as a response to the question: "How much effect do you think each of the following ngs will have in keeping you from getting the job you desire?"*

theoretical model derived from the literature. This model was first tested using our 1966 data and then, in a revised form, with 1968 senior expectations. Our reasoning here is that because the developmental model stresses increasing realism, a student's sophomore level of occupational knowledge might not have an immediate impact on his occupational expectations. But as time passes he will relate such knowledge to his occupational expectations.

* * *


SOPHOMORE OCCUPATIONAL ASPIRATIONS
SOPHOMORE OCCUPATIONAL EXPECTATIONS
SOCIOECONOMIC BACKGROUND
SOPHOMORE PERCEIVED GOAL BLOCKS
LABOR FORCE CHANGE INFORMATION
ROLE KNOWLEDGE INFORMATION
(+)
(+)
(+)
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Model Developed From Ginzberg's Developmental Framework.*

*The arrows show the expected direct and indirect theoretical influences of the variables on sophomore occupational expectations. For example, the line (dashed for illustrative purposes) linking labor force change knowledge with sophomore occupational expectations indicates the direct influence and those lines (also dashed) linking labor force change knowledge, sophomore perceived goal blocks and sophomore occupational expectations indicate the indirect influences of labor force change knowledge on sophomore occupational expectations. The signs in the arrows indicate the expected direction of that influence.

FINDINGS

The Ginzberg Model

The results using the 1966 data did not support the general theoretical model of increasing realism (Figure 1). When the Southern Youth Study data were applied to the developmental model, several of the hypothesized causal influences were found to be unimportant. That is, no statistically significant relationships existed between occupational aspirations and perceived goal blocks or between perceived goal blocks and occupational expectations.[9] Furthermore, there was no empirical evidence that labor force change knowledge significantly influenced occupational expectations.

Because the hypothetically important relationships among social origin, types of occupational knowledge, perceived reality factors and occupational expectations in the derived Ginzberg model were

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[9] *For the statistical results of the models discussed in this bulletin see Howell, F.M., W. Frese and C.R. Sollie "Ginzberg's Theory of Occupational Choice: A Reanalysis of Increasing Realism," Journal of Vocational Behavior,* Vol. 11, 1977, pp. 332-346.

ot confirmed by our data, we con- ructed a revised model (Figure 2), sing senior level occupational ex- ectations (1968 data) and omit- ng labor force change knowledge ecause it has no impact on goal locks or sophomore occupational expectations in the model tested using 1966 data.

Results using the revised model (Figure 2) indicated a significant intervening function played by perceived goal blockages and a small direct impact of the social origin variable on senior occupational expectations. Thus, the revised model using senior occupational expectations better supported Ginzberg's theoretical position.

* * *

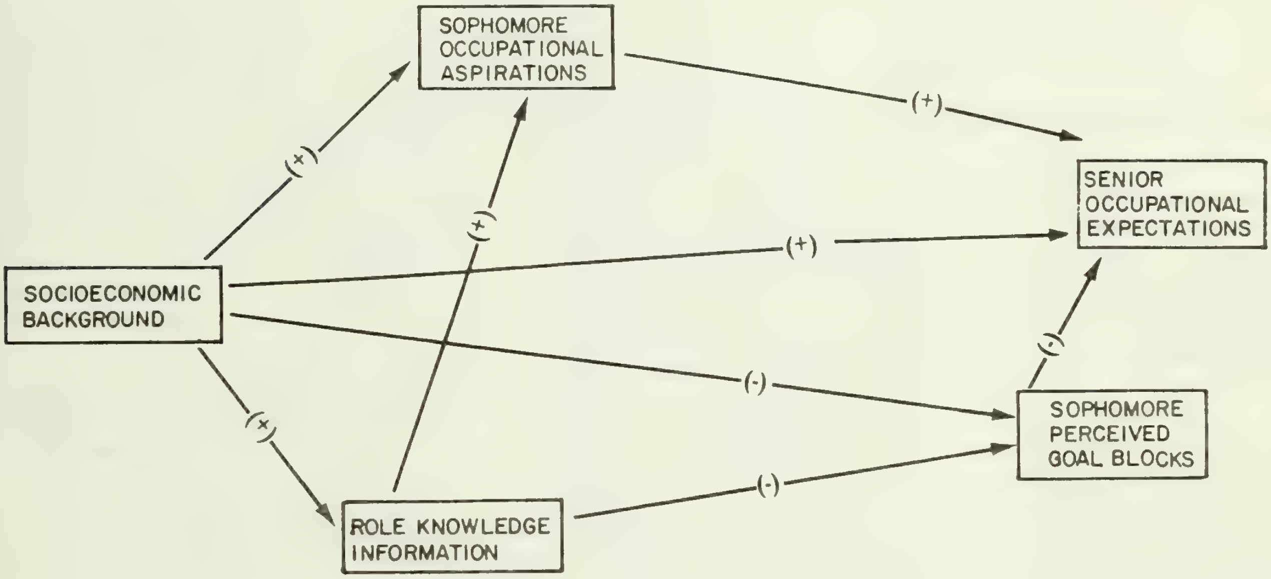
SOPHOMORE OCCUPATIONAL ASPIRATIONS
SENIOR OCCUPATIONAL EXPECTATIONS
SOCIOECONOMIC BACKGROUND
SOPHOMORE PERCEIVED GOAL BLOCKS
ROLE KNOWLEDGE INFORMATION
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Figure 2. Ginzberg's Developmental Model Revised.*

***The arrows represent the statistically significant influences among the variables. The signs indicate the directions of that influence.**

he Ginzberg Model Incorporating Race as a Variable

Because Cosby found that black outh tend to lower their occupa- onal expectations over time while hite youth do not,[10] race was in- oduced as a variable in the model. esults, applying Southern Youth tudy data to the model, showed at race had no direct statistically gnificant impact on senior occu- ational expectations; however, race was a factor in influencing occupational aspirations.[11] That is, role knowledge acted as a mediator of about 35% of the total causal effects of race on occupational aspirations.[12]

Since the direct negative effect of race on senior occupational expectations was not significant, the major causal processes were indirect effects via occupational knowledge and perceived goal blockage. About half (52.4%) of the total association of race on senior occupational expectations was mediated through the intervening variable of perceived goal blocks and occupational knowledge. In addition, the statistically significant relationship between socioeconomic

[10] *Cosby. A.G. "Occupational Expectations and the Hypothesis of Increasing Realism of Choice," Journal of cational Behavior,* Vol. 5, 1974, pp. 53-65.

[11] *See footnote 8.*

[12] *For a detailed statistical report on how we ascertained the direct and indirect effects of the various variables hese models, see reference in footnote 8 or write for a copy of our technical paper (see preface).*

background and perceived goal blocks present in the first two models tested (Figures 1 and 2) disappeared when race was introduced into the model.

In general, most of the total effect of race on occupational expectations of senior males in our panel was actually due to its associations with socioeconomic background. These socioeconomic-based processes functioned primarily through the formation of occupational aspirations. Race and socioeconomic background affected differential role knowledge significantly, and this in turn lowered perceived goal blockage. These intervening variables accounted for more than half of the effects of socioeconomic background and half of the effects of race on senior occupational expectation.

SUMMARY

Some of our more important conclusions about Southern nonmetropolitan male high school students that might be useful in high school counseling are outlined below.

A. Results from the models derived from Ginzberg's developmental framework:
   1. During their sophomore year in high school, socioeconomic status and level of occupational knowledge (both role knowledge and labor force change knowledge) did not influence students' occupational expectations directly nor indirectly via perceived goal blocks. Socioeconomic status and role knowledge did have some indirect influence via sophomore aspirations.
   2. Sophomore socioeconomic status and role knowledge, however, did have some effect on senior occupational expectations directly and via perceived goal blocks. Both socioeconomic status and role knowledge had effects on senior expectations via sophomore aspirations.

B. Results from the model using senior expectations and introducing race:
   1. Sophomore labor force knowledge had no direct or indirect effects on senior occupational expectations.
   2. While socioeconomic status had direct and indirect impacts (via occupational aspirations and via role knowledge-perceived goal blocks) on senior expectations, its effects channeled through perceived goal blocks were not significant.
   3. Race did not directly affect senior occupational expectations; however, because perceived goal blocks affected senior occupational expectations race had indirect impacts by affecting perceived goal blocks and also by affecting role knowledge which in turn affects perceived goal blocks.

C. None of the models tested supported the theoretically important mediating role that perceived goal blocks were expected to play between occupational aspirations and expectations.

IMPLICATIONS FOR COUNSELING

For a young person perhaps the most important aspect of an occupational choice is the degree of realism associated with that choice. The most realistic choice is one in which the individual's aptitudes, aspirations, expectations, knowledge and training coincide with job opportunities. In other words, the job he gets is the one he wants and the one he is best equipped, by aptitudes and training, to perform. The least realistic choice is one in which these factors are most divergent.

Of the variables included in this study that affected occupational choice, labor force change knowledge and occupational role knowledge appeared to be the ones that counseling could handle most effectively to help young people make more realistic choices. Results of our study of Southern nonmetropolitan high school males indicated that, while knowledge of requirements and rewards associated with various occupations affected occupational expectations, labor force change knowledge did not affect students' occupational expectations. A possible explanation as to why knowledge of labor force changes did not have an impact upon sophomore expectations is given by Parnes et al.:

> For youth in school, for example, it is particularly important that they be aware . . . of oc-

> upations potentially availa-
> le to them, of the characteris-
> ics and rewards of different
> ypes of work, and of the en-
> rance requirements . . . For
> dults . . . it is important to
> ave knowledge of available
> . . opportunities.[13]

is statement implies that occu-
tional role knowledge (i.e., char-
eristics and rewards associated
th various occupations) should
ve specific relevance for earlier
upational choices, with labor
ce change knowledge (i.e.,
namic shifts occurring in the
or force structure including
ch things as employment rates
d changes in job opportunities in
rious industries) increasing its
pact on later choices. These find-
s seem to indicate that individ-
ls counseling male high school
dents should concentrate their
ne and energy on supplying stu-
nts with role knowledge rather
an information dealing with
or force changes.

Imparting male high school stu-
nts with role knowledge, how-
er, does not appear to have an immediate, direct effect on their occupational aspirations. The amount of occupational knowledge possessed by high school sophomores affects their occupational aspirations and their perception of barriers to occupational goals and these, in turn, affect occupational expectations at the senior level.

The indirect effect of occupational knowledge on occupational expectations indicates that counseling can affect occupational choice realism by providing occupational role knowledge at the sophomore level.[14]

A goal of educators should be that of helping young people achieve the best possible match between aptitudes, aspirations, expectations and job opportunities. Counselors, teachers and principals with limited time and resources might help students align these variables more effectively by concentrating on the dissemination of knowledge about entrance requirements (e.g., education, skills) and rewards (e.g., income, fringe benefits) associated with various occupations. To the extent that such knowledge affects occupational choice realism, the counseling process can play a significant role in helping students make more realisitic choices.

Our data do not enable us to explain how occupational role knowledge is acquired by young people. Until such information is available, a variety of teaching techniques seems appropriate, depending on the counselor's individual guidance strategy, time and resources. An occupational knowledge program for sophomore high school students might include such things as individual counseling sessions, small group discussions, lectures, guest speakers, films, posters and brochures. The aim should be to communicate information about the role requirements of various types of occupations or at least a broad representation of occupations---especially those with present and future job market potential. This information should concentrate on such things as the amount of education and/or training required, specific tasks involved in doing the job, amount of travel involved and pay.

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[13] *Parnes, H.S., R.C. Miljus, R.A. Spitz and Associates, "Career Thresholds: A Longitudinal Study of the*
cational and Labor Market Experience of Male Youth," U.S. Department of Labor, Manpower Administra-
, Research Monograph No. 16, Vol. 1. (Washington, D.C.: USGOP, 1970.)

[14] *Imparting occupational knowledge at an earlier age might be just as appropriate. We cannot specify an opti-*
l age for this counseling activity because we do not have appropriate longitudinal data on our respondents. Ad-
onal research on occupational knowledge, how it is acquired and how it affects career choices, is critically
ded.

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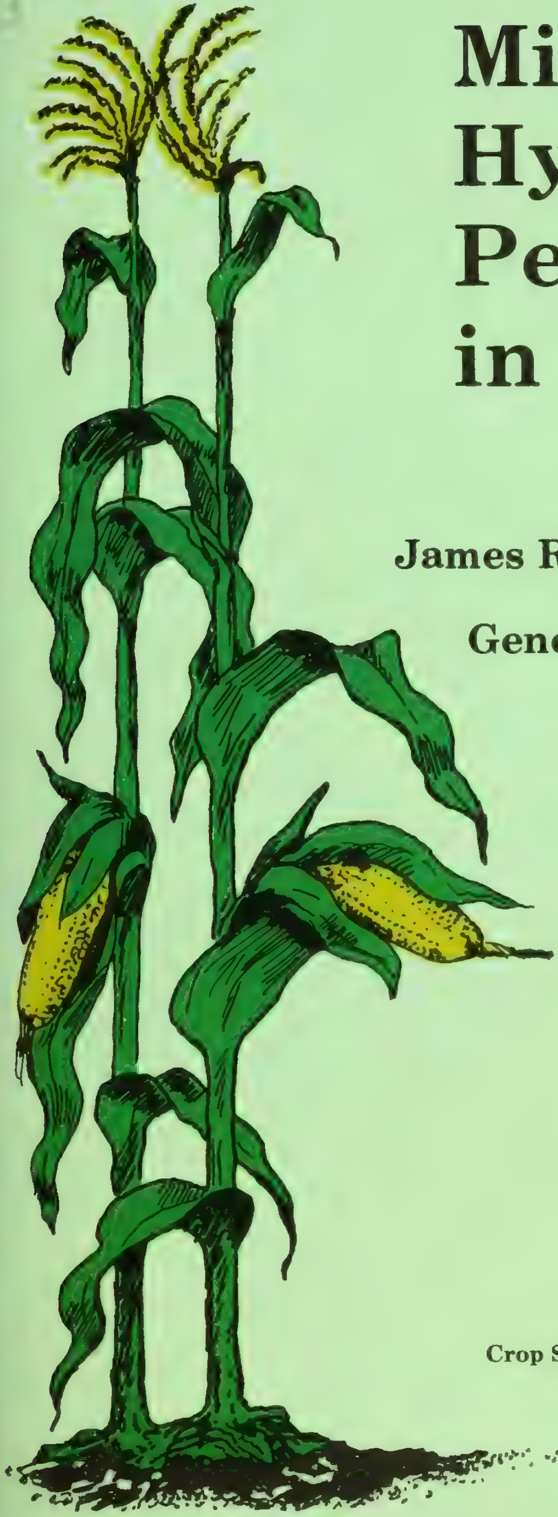
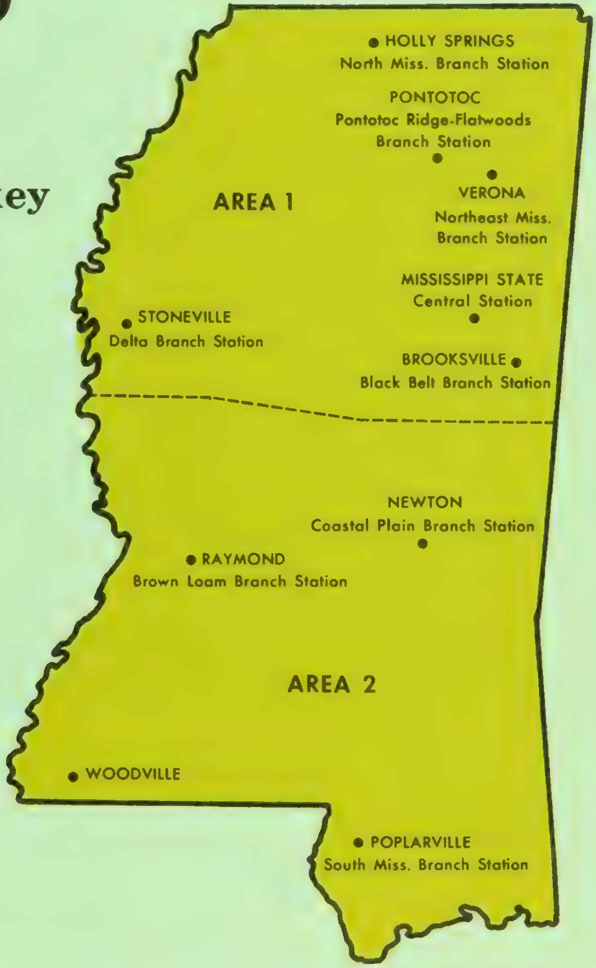


Mississippi Hybrid Corn Performance Trials in 1979

By
James R. McCluskey
and
Gene E. Scott


HOLLY SPRINGS
North Miss. Branch Station
PONTOTOC
Pontotoc Ridge-Flatwoods
Branch Station
VERONA
Northeast Miss.
Branch Station
AREA 1
MISSISSIPPI STATE
Central Station
STONEVILLE
Delta Branch Station
BROOKSVILLE
Black Belt Branch Station
NEWTON
Coastal Plain Branch Station
RAYMOND
Brown Loam Branch Station
AREA 2
WOODVILLE
POPLARVILLE
South Miss. Branch Station

Crop Science and Engineering Research Laboratory
Delta States Area
AR-SEA
U.S. Department of Agriculture
Mississippi State, MS 39762
in cooperation with

MAFES MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
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Mississippi State University
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Authors

James R. McCluskey, research technician
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Normie Buehring, agronomist, Northeast Mississippi Branch Station

Theodore C. Miller, agronomist, Delta Branch Station

Robert E. Coats, superintendent, Black Belt Branch Station

J. W. McMillan, agronomist, Coastal Plains Branch Station

Ned C. Edwards, agronomist, Brown Loam Branch Station

Carl Hovermale, agronomist, South Mississippi Branch Station

The test reported in Wilkinson County was on a private farm through the cooperation of T. O. Whitaker, RFD 4, Woodville, and John Dale, county agent.

Mississippi Hybrid Corn Performance Trials in 1979

Trials are conducted annually in Mississippi to provide farmers, seedsmen, county agents and other interested persons with information on the performance of commercially available corn hybrids. Results of the trials are provided for use by corn producers in selecting hybrids suited to their area. New hybrids may be compared with familiar hybrids and with check hybrids (Dixie 55 and Miss. 6131), which are included in all tests. Seed of Dixie 55 may be commercially available. Seed of Miss. 6131 are not commercially available.

Corn hybrids respond differently to variations in environment, and a given hybrid is not always the best under all conditions. Therefore, it is suggested that corn producers grow two or more good hybrids each year. This practice also reduces the chances for spread of a disease or insect infestation through the total corn acreage.

The yield of harvestable, good-quality grain (or silage) determines the desirability of corn hybrids. However, attributes other than yield may be extremely important in some instances. For example, resistance to a particular disease should be the prime consideration in areas where the disease occurs. That is, hybrids selected should be from those known to have resistance to diseases found in a geographic area.

All producers and/or distributors of seed corn are eligible to enter hybrids in these tests. The producers designate the hybrids they want entered in each area. Hybrids must be submitted for entry to the Mississippi Agricultural and Forestry Experiment Station by Feb. 15. A nominal fee is charged for each hybrid tested in each area to help defray costs of the test.

Three or more tests were located in each area. Trials were conducted at 10 locations in 1978 (Table 1).

The best guide to the desirability of a hybrid is its performance over a period of years at a number of locations. Therefore, three-year summaries are reported for each area.

Table 1. Location, number of entries and dates of planting and harvest of hybrid corn performance trials in Mississippi, 1979.

County	Location	No. of entries	Planting date	Harvest date
Marshall	Holly Springs	41	May 9	Oct. 1
Pontotoc	Pontotoc	41	April 20	Oct. 2
Lee	Verona	41	May 18	Oct. 3
Noxubee	Brooksville	41	May 2	Sept. 28
Oktibbeha	Mississippi State	41	May 1	Oct. 11
Washington	Stoneville	41	March 28	Sept. 7
Newton	Newton	47	March 29 & April 19	--------
Hinds	Raymond	47	March 20	Aug. 30
Wilkinson	Woodville	47	March 21	Aug. 29
Pearl River	Poplarville	47	March 8	Aug. 9

Materials and Methods

The major changes initiated in the 1978 trials were continued---i.e., dividing the state into Area I and Area II and testing at populations of 16,000 and 22,000 plants per acre. A randomized complete-block experimental design with three replications at each population level was used at all locations. Each plot consisted of two rows, 38 or 40 inches apart and 200 inches long. All tests were overplanted and later thinned to either 16,000 or 22,000 plants per acre. Fertilizer was applied by each cooperator as he thought necessary, and weeds were controlled by cultivation and herbicides.

All tests were harvested with a mechanicial picker-sheller. Grain harvested from each plot was weighed, and moisture content was determined. All weights were converted to bushels per acre at 15.5% moisture.

Test Results Area 1

Variability within the Stoneville tests and the high plant population test at Brooksville was so great that differences among the hybrids could not be detected. Therefore, these results are not included in this report. The planting at Pontotoc for the 16,000 plants per acre test was not thinned and these results also are not included in this summary. Root lodging was abnormally high at most locations because of the wind associated with the remnants of hurricane Frederick.

Average yields of the 41 hybrids grown at 16,000 plants per acre were 64, 43, 50 and 74 bu/A at Holly Springs, Verona, Mississippi State and Brooksville, respectively. Average yields over these four locations ranged from 48 to 74 bu/A (Table 2). Root lodging varied from 6 to 43%, and the range in stalk breakage was from 7 to 28%.

The 41 hybrids averaged 56, 43, 56 and 57 bu/A when grown at 22,000 plants per acre at Holly Springs, Verona, Pontotoc and Mississippi State, respectively. Yields over the four locations ranged from 44 to 75 bu/A (Table 3). Root lodging ranged from 9 to 48%,and stalk lodging ranged from 7 to 33%.

The three-year average yields of the 19 hybrids that have been tested at 16,000 plants/A for three years ranged from 63 to 97 with an average of 83 bu/A (Table 4). The older "check" hybrids (Dixie 55 and Miss. 6131) had the highest percentage of stalk lodging.

The three-year average yields of the 28 hybrids that have been tested for two years at 22,000 plants/A ranged from 63 to 85 bu/A (Table 5).

Test Results Area 2

We planted the test at Newton twice but did not harvest the corn because the wind associated with hurricane Frederick flattened the corn. The high plant population portion of the test at Woodville was not harvested.

Average yields of the 47 hybrids grown at 16,000 plants/A were 78, 68 and 82 bu/A at Raymond, Poplarville and Woodville, respectively. Average yields over these the locations ranged from 60 to 94 bu/A (Table 6). Root lodging ranged from 3 to 43%, and stalk lodging varied from 4 to 24%.

Data on performance at the 22,000 plant population level were obtained only at Poplarville and Raymond (Table 7). The highest-yielding hybrid produced 86 bu/A compared to only 52 bu/A for the lowest-yielding entry in the test. Root lodging was higher (7 - 64%) than stalk lodging (4 - 27%).

The three-year average yields of the 28 hybrids that have been tested for three years at 16,000 plants per acre ranged from 56 to 80 bu/A (Table 8).

The three-year average yields of the 32 hybrids that have been tested for two years at 22,000 plants per acre ranged from 60 to 90 bu/A (Table 9). Root and stalk lodging varied from 7 - 45% and 6 - 35% respectively.

Table 2. Summary of performance of 41 hybrids grown at four locations (Holly Springs, Brooksville, Verona and Mississippi State) at 16,000 plants per acre in the 1979 Mississippi hybrid corn performance trials.

Hybrid No.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk*	Moisture	Stand
		bu/A	%	%	cm	no.	%	%
3145	Pioneer	73.9	14	8	177	73	20.3	98
MSX84aa	McCurdy	65.7	10	14	101	69	19.0	89
G-4740	Funk's	64.8	12	21	94	75	20.9	97
RA1502	Ring Around	64.2	7	13	102	76	19.6	96
3179	Pioneer	63.7	25	12	107	70	19.5	95
3147	Pioneer	63.6	23	15	107	71	20.4	94
19	Coker	63.0	18	12	98	69	18.5	96
3369A	Pioneer	62.4	19	9	161	71	18.7	95
G-4709	Funk's	61.4	26	11	99	73	20.5	94
G-4776	Funk's	60.5	21	8	110	76	20.1	97
XL394	DeKalb	59.5	29	14	118	76	20.1	99
77-59	McCurdy	59.5	15	12	102	77	20.2	94
9997	Wilstar	59.3	18	14	98	77	20.4	92
G-4848	Funk's	59.3	15	7	99	76	20.9	95
56	Coker	59.0	9	19	111	76	20.1	98
G-4880W	Funk's	58.8	14	11	117	69	20.4	95
XL72b	DeKalb	58.6	72	11	93	75	19.0	95
55	Dixie	58.3	16	23	184	75	20.2	93
T1189	Trojan	58.1	6	16	155	75	19.9	92
XL72AA	DeKalb	58.0	29	8	99	70	19.3	93
PX95	Northrup King	58.0	28	13	114	76	20.4	90
PX87	Northrup King	57.7	9	11	98	73	20.3	92
RA2601	Ring Around	57.5	27	9	96	68	21.3	89
XL390B	DeKalb	57.5	15	11	177	67	19.9	91
22	Coker	56.9	17	10	99	71	19.7	93
G-4574	Funk's	56.6	27	12	102	76	19.1	94
77	Coker	56.3	26	12	124	73	20.8	92
RA3602	Ring Around	56.2	15	14	110	69	19.8	91
G-4611	Funk's	56.0	29	11	102	70	19.7	90
PX707	Northrup King	54.5	28	9	159	77	20.0	98
6131	Miss	54.5	28	28	123	73	19.2	92
USS1010	Agri-Chemicals	54.0	26	10	163	74	19.3	92
PX79	Northrup King	53.8	35	10	102	69	19.1	95
G-4507	Funk's	53.1	31	17	101	70	19.3	95
XL78	DeKalb	52.1	18	17	91	76	19.6	91
G-795W	Funk's	51	21	25	164	68	19.9	97
TXS114	Trojan	50.9	8	22	92	74	17.9	95
PX723	Northrup King	50.4	24	10	109	76	19.7	104
TXS115A	Trojan	50.1	22	15	101	69	18.8	92
TXS119A	Trojan	48.1	15	13	92	70	19.0	99
XL80	DeKalb	47.5	43	9	92	74	19.7	89
Mean		57.7	20	13	116	73	19.8	94

CV = 17.12%
LSD (.05) = 13.1 bu/A

*Data for Mississippi State Only

Table 3. Summary of performance of 41 hybrids grown at four locations (Holly Springs Pontotoc, Mississippi State and Verona) at 22,000 plants per acre in the 1979 Mississippi hybrid corn performance trials.

Hybrid No.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk*	Moisture	Stand
		bu/A	%	%	cm	no.	%	%
3145	Pioneer	74.5	10	15	118	72	19.3	92
RA1502	Ring Around	70.2	16	22	104	69	18.5	98
3147	Pioneer	65.6	22	27	112	75	18.8	91
G-4740	Funk's	63.5	19	22	98	73	20.2	92
MSX84aa	McCurdy	63.0	9	18	104	72	19.0	95
22	Coker	62.6	10	13	107	70	19.2	95
3369A	Pioneer	61.1	20	19	105	77	17.6	90
XL394	DeKalb	60.9	25	13	126	77	20.2	92
G-4776	Funk's	60.4	22	16	121	69	18.7	95
XL390B	DeKalb	60.2	18	14	114	73	19.5	87
PX95	Northrup King	59.7	28	13	121	74	18.9	93
G-4709	Funk's	59.6	23	18	107	72	19.0	93
3179	Pioneer	58.4	17	24	113	70	18.5	95
XL72b	DeKalb	57.7	15	17	99	70	18.0	94
TXS115A	Trojan	57.7	23	23	107	70	18.3	93
PX707	Northrup King	57.3	23	14	114	73	18.8	96
T1189	Trojan	57.2	13	32	96	73	18.9	95
PX87	Northrup King	56.7	19	13	101	75	19.5	90
19	Coker	56.7	20	23	105	67	17.2	94
77-59	McCurdy	55.5	33	13	102	77	18.9	95
56	Coker	55.1	15	19	112	70	19.0	92
PX79	Northrup King	54.6	30	11	107	74	18.0	94
PX723	Northrup King	54.2	25	11	114	70	24.0	92
9997	Wilstar	53.6	21	17	100	75	20.2	85
G-4507	Funk's	53.4	24	16	105	75	18.6	90
6131	Miss	53.4	39	28	127	79	19.3	91
G-4574	Funk's	53.3	25	20	108	76	18.5	91
G-4611	Funk's	52.6	23	20	109	77	18.3	91
RA2601	Ring Around	52.6	25	16	102	70	20.5	86
G-795W	Funk's	52.4	28	25	113	69	18.9	91
G-4880W	Funk's	52.2	13	19	115	76	19.6	89
USS1010	Agri-Chemicals	52.1	29	16	105	72	17.9	92
RA3602	Ring Around	51.9	28	16	115	77	19.5	87
XL72AA	DeKalb	51.6	26	17	102	67	18.0	93
55	Dixie	51.1	38	27	136	67	17.8	91
XL78	DeKalb	50.6	13	22	96	77	18.5	93
XL80	DeKalb	49.6	48	9	99	68	19.0	95
77	Coker	49.4	31	14	126	74	19.6	86
TSX114	Trojan	48.9	13	33	102	73	18.7	90
TXS119A	Trojan	46.7	12	18	100	72	18.2	92
G-4848	Funk's	43.9	22	7	98	77	20.1	90
Mean		56.1	22	18	109	73	19.0	92

CV = 19.99%

LSD (.05) = 14.7 bu/A

*Data for Mississippi State Only

Table 4. Three-year (1977-79) average performance of 19 hybrids grown in Area I at 16,000 plants per acre in the Mississippi hybrid corn corn performance trials.

Hybrid no.	Brand	Yield bu/A	Lodging root %	Lodging stalk %	Ear height cm	Days to mid silk no.	Moisture %	Stand %
3146	Pioneer	97.2	9	12	127	76	18.2	94
9997	Wilstar	94.8	7	11	116	75	18.4	95
XL394	DeKalb	94.2	11	11	132	77	18.5	99
3145	Pioneer	93.4	5	7	125	74	18.1	93
55	Dixie	89.2	9	27	149	78	18.4	89
G-4880W	Funk's	88.6	6	11	128	78	18.2	99
6131	Miss	87.4	12	36	145	78	17.4	95
77	Coker	85.7	10	14	145	78	18.1	95
22	Coker	84.1	6	8	123	73	16.6	94
G-795W	Funk's	83.3	9	21	123	76	18.1	95
3369A	Pioneer	82.4	6	9	112	73	16.2	95
56	Coker	81.6	4	14	124	77	18.1	96
G-4776	Funk's	80.4	7	8	128	75	17.7	96
XL72b	DeKalb	79.7	4	9	103	73	16.9	92
G-4611	Funk's	76.9	15	11	114	73	17.1	89
TXS114	Trojan	75.4	3	17	115	74	15.7	94
G-4507	Funk's	71.4	10	14	118	73	16.9	97
TXS115A	Trojan	70.1	9	13	115	72	16.6	93
TXS119A	Trojan	62.7	5	11	111	72	16.3	97
Mean		83.1	8	14	124	75	17.5	95

Table 5. Two-year (1978-79) average performance of 28 hybrids grown in Area I at 22,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid no.	Brand	Yield bu/A	Lodging root %	Lodging stalk %	Ear height cm	Days to mid silk no.	Moisture %	Stand %
3145	Pioneer	84.6	6	11	128	76	17.7	96
MSX84aa	McCurdy	82.7	5	17	116	73	17.4	94
3147	Pioneer	80.1	12	19	123	75	17.1	92
9997	Wilstar	79.4	14	15	113	75	18.4	90
RA 1502	Ring Around	79.4	9	20	113	73	17.2	95
XL72b	DeKalb	77.0	9	12	107	73	16.5	97
XL78	DeKalb	76.5	8	16	106	73	17.1	94
G-4776	Funk's	76.4	12	14	131	77	17.4	97
3179	Pioneer	76.0	12	25	125	76	16.9	96
22	Coker	75.8	6	15	116	75	17.2	96
XL394	DeKalb	74.3	21	13	137	77	18.2	94
G-4507	Funk's	74.3	11	16	113	74	17.2	95
TXS115A	Trojan	73.9	16	18	116	73	16.6	92
G-4709	Funk's	73.8	15	16	115	74	17.4	94
3369A	Pioneer	73.7	11	25	115	72	16.5	90
RA 2601	Ring Around	73.1	16	21	119	76	17.9	91
PX95	Northrup King	72.3	17	10	134	76	17.4	92
56	Coker	70.8	8	15	125	77	17.7	95
PX723	Northrup King	70.5	16	15	126	75	19.9	92
G-4574	Funk's	70.1	14	20	119	72	16.8	94
G-4611	Funk's	69.9	15	18	119	75	17.2	93
G-4880W	Funk's	69.6	8	16	126	78	17.8	92
TXS114	Trojan	66.9	7	24	111	75	17.2	91
55	Dixie	65.6	22	25	144	77	16.9	92
G-795W	Funk's	65.6	18	24	124	77	17.6	93
TXS119A	Trojan	65.3	7	16	109	75	16.7	95
6131	Miss	64.7	22	20	133	77	18.1	94
77	Coker	62.7	20	14	142	77	17.9	91
Mean		72.8	13	18	122	75	17.4	94

Table 6. Summary of performance of 47 hybrids grown at three locations (Poplarvill Raymond and Woodville) at 16,000 plants per acre in the 1979 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Mois-ture	Stan
no.		bu/A	%	%	cm.	%	%
XL395a	DeKalb	93.6	21	7	109	20.4	101
3147	Pioneer	86.8	14	11	113	17.8	98
UC12052	Paymaster	86.2	33	10	108	20.0	100
UC8951	Paymaster	85.5	5	5	105	18.1	100
MSX84aa	McCurdy	84.5	5	11	104	17.6	98
XA730C	Pioneer	83.8	14	10	100	17.4	100
G-4848	Funk's	83.6	12	5	97	20.8	97
PX95	Northrup King	83.6	9	6	116	18.9	97
3369A	Pioneer	82.6	5	6	92	17.9	99
PX87	Northrup King	82.4	3	8	96	18.2	98
3145	Pioneer	82.3	6	5	104	18.0	99
67-14	McCurdy	82.3	35	15	102	20.0	98
76-25	McCurdy	82.0	14	10	125	20.5	99
RA1502	Ring Around	81.9	1	4	98	17.0	100
G-4740	Funk's	81.5	3	7	89	18.9	99
55	Dixie	80.5	26	24	129	18.4	99
19	Coker	79.2	4	4	98	17.0	98
3040	Pioneer	78.4	19	8	105	20.1	99
X5407	Pioneer	77.8	16	5	93	17.1	99
XL80b	DeKalb	77.7	26	10	94	18.7	98
G-4709	Funk's	77.3	12	10	102	18.0	97
3030	Pioneer	77.2	20	13	104	19.7	100
G-4574	Funk's	77.0	14	9	101	18.0	97
22	Coker	76.8	4	11	97	18.0	97
MSX86A	McCurdy	76.6	5	8	89	18.1	95
XL390B	DeKalb	76.2	9	18	116	18.1	99
77	Coker	74.6	17	9	127	19.1	100
PX707	Northrup King	74.2	16	11	104	16.4	98
RA2601	Ring Around	73.1	19	10	102	19.9	95
T1189	Trojan	72.7	6	10	93	16.8	97
TXS115A	Trojan	72.4	5	5	103	16.6	99
G-4880W	Funk's	71.4	10	7	108	20.0	99
XL394	DeKalb	71.1	30	10	103	18.6	97
G-4776	Funk's	71.1	16	14	103	18.5	100
G-795W	Funk's	69.9	25	13	114	18.4	101
G-5945	Funk's	69.0	29	10	114	19.9	97
G-4949A	Funk's	68.8	22	18	120	19.4	97
TXS114	Trojan	68.3	2	13	97	16.7	98
9997	Wilstar	67.8	28	14	96	19.9	93
RA3602	Ring Around	67.0	9	7	104	17.0	95
XL80	DeKalb	65.9	26	13	92	18.2	98
TXS119A	Trojan	65.7	7	6	92	17.0	99
PX79	Northrup King	64.8	9	3	98	16.6	99
6131	Miss	62.2	43	25	123	18.2	102
PX723	Northrup King	61.1	12	10	101	16.5	92
56	Coker	61.0	13	11	107	19.0	99
USS2010	Agri-Chemicals	60.4	5	9	86	16.9	98
Mean		75.8	15	10	104	18.3	98

CV = 13.62%
LSD(.05) = 14.6 bu/A

Table 7. Summary of performance of 47 hybrids grown at two locations (Poplarville and Raymond) at 22,000 plants per acre in the 1979 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging Root	Lodging Stalk	Ear Height	Moisture	Stand
no.		bu/A	%	%	cm.	%	%
MSX84aa	McCurdy	86.4	9	9	96	17.5	97
G-4740	Funk's	85.9	15	7	93	19.9	99
UC12052	Paymaster	84.9	59	8	102	20.7	99
UC8951	Paymaster	84.2	8	9	100	16.7	99
3147	Pioneer	82.9	16	7	105	18.3	95
19	Coker	82.8	20	8	99	16.6	100
PX87	Northrup King	82.7	9	13	92	18.4	96
3145	Pioneer	81.3	11	11	98	18.7	97
3040	Pioneer	79.5	33	10	105	18.5	99
XL395a	DeKalb	79.1	25	7	102	20.4	96
G-4709	Funk's	77.6	24	9	97	17.2	97
RA1502	Ring Around	77.1	13	15	89	18.1	98
MSX86A	McCurdy	77.0	23	12	102	19.0	98
TXS115A	Trojan	76.8	25	12	98	16.6	100
PX707	Northrup King	75.9	31	15	103	18.7	91
XA730C	Pioneer	75.3	18	9	95	17.7	100
76-25	McCurdy	75.1	30	21	120	19.8	100
RA2601	Ring Around	74.9	36	13	101	19.8	94
T1189	Trojan	74.8	7	25	89	17.8	96
PX95	Northrup King	73.5	13	12	118	18.7	95
9997	Wilstar	73.2	34	11	105	20.7	91
67-14	McCurdy	72.1	55	19	95	20.0	96
XL394	DeKalb	72.1	37	8	104	18.4	95
X5407	Pioneer	70.4	17	11	88	16.2	99
XL80b	DeKalb	70.4	41	12	88	17.6	95
3369A	Pioneer	69.9	10	12	90	16.3	96
TXS114	Trojan	69.3	14	24	89	16.4	100
G-4949A	Funk's	68.7	35	14	105	20.5	99
G-4574	Funk's	68.6	28	19	97	17.4	95
XL390B	DeKalb	68.5	25	18	112	18.8	97
G-4848	Funk's	68.5	30	4	93	20.8	90
PX723	Northrup King	68.1	38	9	107	17.9	97
56	Coker	67.6	14	20	109	18.9	94
22	Coker	66.5	11	17	97	18.6	98
PX79	Northrup King	64.8	25	6	95	17.7	99
G-795W	Funk's	64.0	47	17	104	18.4	95
G-5945	Funk's	64.0	43	13	110	19.6	96
55	Dixie	63.0	33	27	121	19.2	94
3030	Pioneer	62.8	35	10	116	19.8	94
TXS119A	Trojan	62.5	13	15	95	16.9	91
G-4776	Funk's	62.2	19	17	104	18.0	96
6131	Miss	60.2	64	16	129	18.3	95
G-4880W	Funk's	59.7	35	8	100	19.0	96
USS2010	Agri-Chemicals	59.5	15	15	83	18.4	95
77	Coker	59.0	39	11	124	20.7	96
RA3602	Ring Around	57.8	18	13	105	18.3	87
XL80	DeKalb	52.0	68	18	90	17.6	93
Mean		71.5	27	13	101	18.5	96

CV = 14.27%

LSD(.05) = 13.9 bu/A

Table 8. Three-year (1977-79) average performance of 24 hybrids grown in Area II at 16,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Mois-ture	Stand
no.		bu/A	%	%	cm.	%	%
UC12052	Paymaster	79.5	14	4	108	20.5	94
3147	Pioneer	73.8	5	13	104	19.0	96
RA1502	Ring Around	72.7	0	3	96	18.3	96
PX95	Northrup King	71.2	3	5	117	20.0	96
3030	Pioneer	71.2	10	9	106	20.2	97
3145	Pioneer	70.2	3	9	103	19.1	95
55	Dixie	69.7	13	21	128	19.7	94
22	Coker	68.7	2	14	99	16.5	94
77	Coker	68.5	7	7	124	19.3	96
RA2601	Ring Around	67.8	10	10	101	20.8	92
3369A	Pioneer	66.9	2	11	87	17.9	95
XL394	DeKalb	66.8	16	8	113	19.6	96
G-4949A	Funk's	65.0	12	9	118	19.4	95
G-5945	Funk's	63.4	16	8	119	19.6	94
TXS114	Trojan	63.3	1	19	98	16.5	93
G-4880W	Funk's	63.3	5	7	106	19.4	97
G-795W	Funk's	62.9	15	16	108	19.2	96
9997	Wilstar	61.6	13	15	99	20.7	94
PX79	Northrup King	60.7	4	9	98	17.0	94
TXS115A	Trojan	60.1	3	12	100	16.0	93
G-4776	Funk's	58.8	6	12	114	17.1	94
56	Coker	57.0	6	12	110	19.5	95
TXS119A	Trojan	56.7	3	9	94	17.4	95
6131	Miss	55.9	18	23	122	19.1	95
MEAN		65.8	8	11	107	18.8	95

Table 9. Two-year (1978-79) average performance of 32 hybrids grown in Area II at 22,000 plants per acre in the Mississippi hybrid corn performance trials.

			Lodging		Ear	Mois-	
Hybrid	Brand	Yield	root	stalk	height	ture	Stand
no.		bu/A	%	%	cm.	%	%
3147	Pioneer	89.8	15	8	107	17.8	91
UC12052	Paymaster	89.2	37	6	111	20.0	92
3145	Pioneer	83.7	7	12	104	17.9	93
3040	Pioneer	83.0	25	9	114	18.7	94
XL394	DeKalb	81.7	27	12	116	18.7	92
22	Coker	81.5	10	18	107	17.8	94
RA1502	Ring Around	80.8	9	14	99	17.3	94
RA2601	Ring Around	80.8	21	21	109	19.3	92
G-4574	Funk's	79.9	18	23	108	17.0	91
67-14	McCurdy	79.8	33	25	102	19.0	89
3369A	Pioneer	79.3	9	18	98	16.3	93
TXS115A	Trojan	78.7	16	16	105	16.3	92
G-4709	Funk's	78.4	21	11	105	17.1	94
TXS114	Trojan	77.2	10	21	99	16.4	93
9997	Wilstar	77.1	26	13	109	19.4	90
3030	Pioneer	76.5	25	10	124	19.6	92
76-25	McCurdy	76.4	17	21	131	19.3	97
PX95	Northrup King	76.2	8	20	125	17.8	91
PX723	Northrup King	76.2	23	17	122	17.3	91
G-4949A	Funk's	73.0	26	12	115	19.4	96
G-795W	Funk's	72.9	28	20	113	17.9	92
G-4776	Funk's	72.1	11	19	117	17.8	93
77	Coker	71.2	24	14	136	19.4	93
RA3602	Ring Around	70.7	10	22	112	17.8	86
55	Dixie	70.2	21	34	129	18.4	91
PX79	Northrup King	70.0	19	12	107	17.1	94
56	Coker	68.2	8	24	118	18.7	91
XL80	DeKalb	66.4	45	13	95	17.0	91
G-4880W	Funk's	64.5	23	10	111	18.8	94
TXS119A	Trojan	63.3	9	18	99	16.6	89
G-5945	Funk's	62.4	32	19	123	18.4	92
6131	Miss	60.1	36	35	136	17.0	91
MEAN		75.5	20	17	113	18.0	92

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In conformity with Title IX of the Education Amendments of 1972 and Section 504 of the Rehabilitation Act of 1973, Dr. T. K. Martin, Vice President, 610 Allen Hall, P. O. Drawer J, Mississippi State, Mississippi 39762, office telephone number 325-3221, has been designated as the responsible employee to coordinate efforts to carry out responsibilities and make investigation of complaints relating to nondiscrimination.

Lithograph
Central Duplicating
Mississippi State University

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Mississippi Cotton Variety Tests in 1979

By
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Mississippi Cotton Variety Tests in 1979

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Mississippi Cotton Variety Tests in 1979

The Mississippi cotton variety testing program is a continuous evaluation of cotton varieties available from private companies and state agricultural experiment stations. The tests are conducted in the delta and hill areas of Mississippi to determine the relative performance of available varieties and to provide a guide to producers and other agricultural workers in selecting the best adapted varieties with the highest yield potential, earliness and fiber quality for their area. The 1979 trials were conducted in four delta environments (Sumner, Tunica, and two test sites at Stoneville) and three hill area environments (Holly Springs, Verona and Mississippi State).

Each entry was randomized and replicated six times. Yield determinations were based on the weight of cotton harvested from two-row plots. Determinations of lint percentage, boll size, seed index and fiber properties were made from hand-picked samples. Fiber property evaluations were made in the USDA Cotton Fiber Laboratory at Knoxville, Tennessee and the MAFES Cotton Fiber Laboratory at Stoneville, Mississippi.

The same 17 varieties were evaluated in all delta tests, and two other varieties, Acala SJ-5 and Paymaster 303, were included in one Stoneville test and the Tunica test because they are part of a cooperative regional variety testing program. DES 422, HAS 7193, Deltapine 70, and Stoneville 506 were evaluated for the first time. Deltapine 41 previously was tested as Deltapine 7141.

Results

Delta, 1979

The Stoneville test on a Bosket very fine sandy loam soil was planted May 7. Excessive rain and cool temperatures after planting resulted in slow stand establishment. Excessive rain prevailed throughout the growing season and a major portion of the corp was set in August. The test was harvested twice and lint yields ranged from 217 to 1,252 lbs/acre (Table 1). Maturity at first harvest on October 8 ranged from 50 to 81%, and the earlier varieties generally produced the highest lint yields. This occurred because the crop matured later than usual, and the major portion of the crop was set in a short period of time.

The Sumner test was planted May 1 on a Dubbs sandy loam soil. This test was harvested twice, and earliness at first harvest on October 8 ranged from 64 to 78%. Lint yields ranged from 1,084 to 1,279 lbs/acre (Table 2). Varieties at this location were less vegetative than at Stoneville and Tunica. Yield at Sumner was not as closely associated with maturity as at the other locations.

Planting of the test at Tunica on a Dundee silt loam soil was delayed until May 16 because of excessive soil moisture and low temperatures. Good stands were obtained, but the crop matured very slowly and was harvested only once after a freeze on November 14. Lint yields ranged from 85 to 615 lbs/acre, with the earlier varieties generally producing the highest lint yields (Table 3). Many small immature bolls were destroyed by the freeze, particularly on the later-maturing varieties.

The test at Stoneville on a mixed soil was planted on April 18. Growing conditions were poor and a considerable amount of spot planting was done to secure good stands. This test was harvested twice, and earliness at first harvest on October 15 ranged from 81 to 87%. Lint yields ranged from 713 to 900 lbs/acre (Table 4). Maturity differences between varieties were less obvious than in other tests, but the earlier varieties tended to produce the highest lint yields.

Average yield of the 17 varieties that were tested in the four environments in 1979 ranged from 779 to 1,002 lbs/acre, and earliness at first harvest ranged from 71 to 82%. With one exception, the lowest lint yields were obtained from the latest-maturing varieties(Table 5).

Delta, Two-Year and Three-Year Averages

Average lint yields of the 13 varieties that have been grown in seven Delta environments over the wo-year period (1978-79) ranged from 892 to 1,035 lbs/acre. Earliness at first harvest ranged from 73 to 83% (Table 6). Average lint yield of the ten varieties that have been tested in 11 Delta environments for three years (1977-1979) ranged from 946 to 1,048 lbs/acre, and maturity at first pick ranged from 76 to 84% (Table 7).

Hill Area, 1979

The test on a Leeper fine sandy loam at Mississippi State was planted on May 8. This test was harvested once on November 1, and lint yields ranged from 784 to 994 lbs/acre. (Table 8).

Planting on a Catalapa silty clay loam soil at Verona was delayed until May 17 due to unfavorable weather. This test was harvested once on November 5, and lint yields ranged from 287 to 457 lbs/acre (Table 9). This test received eight insecticide applications.

The test at Holly Srpings on a Grenada silt loam soil was planted on May 11. This test was harvested twice, and maturity at first harvest on October 24 ranged from 61 to 76%. Lint yields ranged from 486 to 744 lbs/acre (Table 10). A killing frost on October 14 reduced yields by damaging many unopened bolls. The test was sprayed once for thrips, once for fleahoppers an plant bugs and five times fo worms. There appeared to be considerable plant bug an fleahopper damage but no worm o weevil damage.

Average lint yields of the 1 varieties grown in the three hil environments in 1979 ranged fron 555 to 732 lbs/acre (Table 11).

Holly Springs, Two-Year and Three-Year Averages

Average lint yield and earliness of the 11 varieties that have been grown for two years (1978-1979) and the seven varieties that have been grown for three years at Holly Springs (1977-1979) are presented in Table 12. Lint yields of the 11 varieties over the two-year period ranged from 724 to 819 lbs/acre, and maturity at first harvest ranged from 53 to 68%. Lint yields of th seven varieties over the three-yea period ranged from 700 to 78 lbs/acre, and maturity at firs harvest ranged from 60 to 70%.

Table 1. Results of the 1979 Cotton Variety Test on a Bosket very fine sandy loam soil at Stoneville, Miss.

	Lint Per Acre						Fiber Properties				
			Percent			Boll	Length				
	Total	First pick	first pick	Lint percent	Seed index	size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
DES 422	1252	1006	80	39.4	10.0	5.17	1.13	.57	18.64	8.8	4.1
Deltapine 41	1240	926	75	42.0	9.7	5.53	1.15	.58	20.02	8.8	4.5
Stoneville 506	1215	979	81	38.4	11.0	5.41	1.11	.55	18.97	10.1	4.2
DES 56	1171	922	79	38.7	10.2	5.20	1.14	.59	19.93	8.5	4.3
Deltapine 55	1161	882	76	40.8	10.1	5.50	1.13	.54	18.41	8.7	4.2
Stoneville 825	1144	824	72	38.3	10.9	5.34	1.13	.56	19.12	8.1	4.6
DES 24	1066	809	76	38.0	11.4	5.49	1.16	.57	19.54	9.2	4.3
Coker 315	1065	726	68	40.2	10.4	5.55	1.18	.59	20.22	7.7	4.4
McNair 235	1063	823	77	39.3	10.5	5.41	1.12	.56	19.94	7.8	4.4
Deltapine 26	1054	711	67	41.7	9.7	5.27	1.10	.56	19.71	9.2	4.7
Coker 310	1036	775	75	39.6	11.2	5.49	1.17	.57	19.94	8.0	4.5
Deltapine 61	1030	662	64	39.8	10.4	5.74	1.13	.56	19.83	9.3	4.6
HAS 7193	1028	738	72	39.2	11.7	5.58	1.17	.60	21.00	9.3	4.4
Stoneville 213	1027	739	72	37.7	10.9	5.46	1.13	.58	18.15	9.3	4.5
Coker 304	1021	701	69	39.3	10.4	5.52	1.18	.60	19.95	7.2	4.3
Stoneville 256	1008	651	65	38.6	10.8	5.53	1.13	.57	19.44	7.9	4.8
Deltapine 70	1005	711	71	40.1	9.5	4.97	1.13	.57	20.09	8.4	4.4
Paymaster 303	728	485	67	37.0	11.9	5.81	1.08	.53	20.41	8.6	4.1
Acala SJ-5	217	108	50	37.1	11.6	5.31	1.13	.57	22.79	7.2	4.1
LSD .05	90										
C.V.	7.2										

Planted: May 7, 1979
Harvested: October 8 and November 5, 1979

Table 2. Results of the 1979 Cotton Variety Test on a Dubbs sandy loam soil at Sumner, Miss.

	Lint Per Acre						Fiber Properties				
							Length				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
Deltapine 41	1279	908	71	41.0	9.5	5.37	1.15	.58	19.63	7.6	4.6
Coker 315	1268	909	72	39.4	10.8	5.80	1.23	.61	20.21	7.5	4.5
McNair 235	1261	940	74	38.5	11.3	5.35	1.15	.59	20.30	7.3	4.5
Coker 304	1255	959	76	38.4	11.6	5.84	1.19	.62	20.92	7.6	4.4
DES 422	1245	967	78	39.8	10.4	5.17	1.16	.59	19.25	8.7	4.4
DES 56	1236	960	78	38.5	10.7	5.25	1.15	.58	20.23	9.4	4.6
Stoneville 825	1234	843	68	38.5	11.8	5.28	1.14	.58	18.99	7.4	5.0
Deltapine 55	1219	891	73	40.5	10.3	5.47	1.15	.57	19.32	9.4	4.4
Coker 310	1200	876	73	37.2	11.8	6.02	1.22	.62	20.17	8.3	4.3
Deltapine 61	1197	827	69	39.6	10.4	5.70	1.17	.60	19.35	10.5	4.7
Stoneville 213	1153	795	69	38.3	11.2	5.46	1.15	.58	18.57	8.6	4.8
Stoneville 506	1153	837	73	37.7	11.5	5.40	1.15	.58	19.05	9.6	4.5
Deltapine 26	1150	734	64	39.4	10.6	5.23	1.14	.58	20.67	9.5	4.8
Deltapine 70	1134	803	71	39.1	9.6	4.92	1.16	.60	20.00	7.6	4.6
DES 24	1130	787	70	37.7	12.0	5.63	1.20	.61	20.50	8.4	4.6
HAS 7193	1100	793	72	38.5	12.1	5.87	1.22	.62	21.35	9.7	4.6
Stoneville 256	1084	722	67	38.0	11.6	5.48	1.15	.58	18.82	6.9	4.8
LSD .05	85										
C.V.	6.3										

Planted: May 1, 1979
Harvested: October 8 and October 30, 1979

Table 3. Results of the 1979 Cotton Variety Test on a Dundee sandy loam soil at Tunica, Miss.

	Lint/Acre				Fiber Properties				
					Length				
	Total	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
Stoneville 825	615	36.6	12.0	5.72	1.15	.58	18.66	7.2	4.6
DES 422	613	38.1	12.1	5.93	1.14	.55	17.82	8.4	4.2
DES 56	572	36.6	11.9	5.93	1.15	.58	19.41	9.1	4.1
HAS 7193	543	38.3	12.4	6.00	1.17	.58	20.44	10.2	4.3
Deltapine 41	540	40.7	10.3	5.72	1.15	.57	19.66	9.1	4.1
DES 24	539	37.4	12.6	6.21	1.19	.59	19.04	8.9	4.6
Stoneville 506	536	36.4	12.1	5.66	1.16	.59	18.24	8.2	3.9
McNair 235	453	36.5	12.0	5.93	1.16	.60	18.90	7.1	4.3
Deltapine 55	441	38.2	11.4	5.99	1.15	.56	17.08	8.3	4.1
Stoneville 213	417	36.3	11.8	6.03	1.13	.56	17.83	8.8	4.4
Deltapine 70	412	37.8	10.7	5.35	1.14	.58	19.17	8.3	4.4
Coker 310	403	37.1	12.1	6.40	1.20	.60	19.63	7.2	4.2
Coker 304	387	37.2	11.5	6.10	1.20	.60	19.89	7.8	4.1
Deltapine 26	340	37.9	11.1	5.51	1.13	.56	17.94	8.9	4.1
Coker 315	318	37.5	11.9	6.03	1.21	.62	19.30	7.6	4.1
Stoneville 256	312	35.5	11.6	5.91	1.14	.55	17.32	7.2	4.2
Deltapine 61	294	36.5	11.9	6.10	1.17	.59	19.10	9.2	4.3
Paymaster 303	234	35.5	12.8	6.66	1.10	.56	18.54	7.4	3.9
Acala SJ-5	85	35.9	12.6	6.33	1.16	.61	22.15	7.6	3.8
LSD .05	83								
C.V.	16.0								

Planted: May 16, 1979
Harvested: November 14, 1979

Table 4. Results of the 1979 Cotton Variety Test on a mixed soil at Stoneville, Miss.

	Lint Per Acre						Fiber Properties				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire
DES 422	900	779	87	38.7	9.8	4.40	1.15	.57	19.74	8.7	4.3
Stoneville 506	896	781	87	37.3	10.5	4.91	1.12	.56	18.57	8.2	4.5
Stoneville 825	864	717	83	37.9	10.4	4.73	1.13	.56	18.98	6.1	4.9
DES 56	854	737	86	38.0	10.7	4.74	1.13	.55	20.12	8.9	4.6
DES 24	847	715	84	37.6	10.8	4.63	1.18	.60	20.32	7.5	4.6
Deltapine 55	820	700	85	39.2	9.9	4.90	1.12	.54	17.96	7.8	4.3
HAS 7193	815	674	83	37.4	11.2	5.35	1.14	.57	20.26	9.2	4.4
Deltapine 61	812	666	82	38.3	10.0	5.17	1.11	.54	18.82	9.9	4.8
Stoneville 213	804	667	83	37.1	10.6	5.07	1.14	.56	19.40	8.9	4.7
Coker 315	804	656	82	39.2	10.1	4.89	1.22	.62	21.04	6.8	4.6
McNair 235	798	672	84	37.9	10.5	5.03	1.11	.56	19.46	6.6	4.6
Deltapine 41	787	674	86	40.9	9.0	4.72	1.11	.55	19.23	7.8	4.5
Coker 310	782	652	83	37.1	10.8	5.25	1.22	.62	20.99	7.5	4.2
Deltapine 26	771	626	81	40.4	9.7	4.64	1.14	.59	19.38	8.1	4.7
Deltapine 70	755	623	82	38.5	9.0	4.28	1.14	.59	20.40	8.2	4.4
Coker 304	736	611	83	37.9	10.6	5.33	1.17	.57	20.18	7.3	4.5
Stoneville 256	713	584	82	37.9	10.6	5.06	1.12	.56	18.45	8.0	4.8
LSD .05	103										
C.V.	14.0										

Planted: April 18, 1979
Harvested: October 15 and November 6, 1979

Table 5. Average performance of 17 cotton varieties grown in four Delta environments[1] in 1979.

	Lint Per Acre					Fiber Properties				
	Total	Percent first pick	Lint percent	Seed index	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire
DES 422	1002	82	39.0	10.5	5.17	1.14	.57	18.86	8.6	4.3
Stoneville 825	964	74	37.8	11.3	5.27	1.14	.57	18.93	7.2	4.7
Deltapine 41	961	77	41.1	9.6	5.33	1.14	.57	19.63	8.3	4.4
DES 56	958	81	37.9	10.9	5.28	1.14	.57	19.92	9.0	4.4
Stoneville 506	950	80	37.4	11.3	5.34	1.13	.57	18.70	9.0	4.3
Deltapine 55	910	78	39.7	10.4	5.46	1.14	.55	18.19	8.5	4.3
DES 24	896	77	37.7	11.7	5.49	1.18	.59	19.85	8.5	4.5
McNair 235	894	78	38.0	11.1	5.43	1.13	.58	19.65	7.2	4.4
HAS 7193	817	76	38.3	11.8	5.70	1.17	.59	20.76	9.6	4.4
Coker 315	864	74	39.0	10.8	5.57	1.21	.61	20.19	7.4	4.4
Coker 310	855	77	37.7	11.5	5.79	1.20	.60	20.18	7.7	4.3
Stoneville 213	850	74	37.3	11.1	5.50	1.14	.57	18.49	8.9	4.6
Coker 304	850	76	38.2	11.0	5.75	1.18	.60	20.23	7.5	4.3
Deltapine 61	833	72	38.5	10.7	5.68	1.14	.57	19.27	9.7	4.6
Deltapine 26	829	71	39.8	10.3	5.16	1.13	.57	19.42	8.9	4.6
Deltapine 70	826	75	38.9	9.7	4.88	1.14	.58	19.91	8.1	4.4
Stoneville 256	779	71	37.5	11.1	5.49	1.13	.56	18.51	7.5	4.6
LSD .05	52									
C.V.	9.5									

[1] **Four environments - Stoneville 2, Tunica, and Sumner.**

Table 6. Performance of 13 cotton varieties grown in seven Delta environments[1], 1978-79 average.

	Lint Per Acre					Fiber Properties				
	Total	Percent first pick	Lint percent	Seed index	Boll Size grams	Length		Strength g/tex	Elonga-tion	Micro-naire
						2.5%	50%			
DES 56	1035	83	37.8	10.9	5.19	1.15	.58	19.66	8.6	4.5
McNair 235	1031	80	38.4	11.1	5.41	1.14	.58	19.49	7.1	4.6
Deltapine 41	1030	79	41.1	9.5	5.23	1.15	.57	19.74	8.0	4.5
Stoneville 825	1010	78	38.0	11.2	5.25	1.14	.57	18.73	6.9	4.8
Deltapine 55	992	80	39.5	10.4	5.32	1.15	.56	18.39	8.2	4.4
DES 24	979	79	37.6	11.8	5.53	1.18	.59	19.96	8.4	4.6
Deltapine 26	978	73	40.3	10.3	5.16	1.13	.57	19.46	8.5	4.7
Coker 310	962	78	37.7	11.5	5.81	1.20	.60	20.21	7.5	4.4
Coker 315	958	77	38.9	10.9	5.48	1.21	.60	20.18	7.6	4.5
Stoneville 213	957	76	37.2	11.2	5.21	1.14	.57	18.55	8.5	4.8
Deltapine 61	946	74	38.3	10.7	5.64	1.15	.58	19.56	9.7	4.7
Coker 304	938	78	37.9	11.2	5.58	1.19	.59	20.43	7.2	4.4
Stoneville 256	892	74	37.8	11.0	5.43	1.14	.56	18.37	7.0	4.7

[1] Seven environments - Stoneville 3, Sumner 2, Tunica 2.

Table 7. Performance of 10 cotton varieties grown in 11 Delta environments[1], 1977-79 average.

	Lint Per Acre					Fiber Properties				
	Total	Percent first pick	Lint percent	Seed index	Boll size grams	Length		Strength g/tex	Elonga-tion	Micro-naire
						2.5%	50%			
DES 56	1048	84	37.5	11.0	5.03	1.15	.57	19.16	8.1	4.5
Stoneville 825	1038	80	37.8	11.3	5.14	1.14	.56	18.51	6.7	4.8
Deltapine 26	1010	76	40.2	10.4	5.07	1.13	.56	19.50	7.9	4.8
DES 24	1009	81	37.4	11.8	5.45	1.18	.58	20.14	8.2	4.6
Deltapine 55	1005	82	39.4	10.2	5.17	1.15	.55	18.47	7.9	4.4
Coker 310	999	80	37.4	11.6	5.75	1.20	.59	19.94	7.2	4.4
Stoneville 213	979	79	37.1	11.2	5.20	1.14	.56	18.46	8.2	4.7
Deltapine 61	975	77	38.2	10.7	5.53	1.15	.57	19.63	9.4	4.7
Coker 304	956	80	37.7	11.4	5.51	1.19	.59	20.16	7.0	4.4
Stoneville 256	946	76	37.7	11.2	5.33	1.14	.55	18.36	6.7	4.7

[1] Eleven environments - Stoneville 5, Sumner 3, Tunica 3.

Table 8. Results of the 1979 Cotton Variety Test on a Leeper fine sandy loam soil at Mississippi State Miss.

				Fiber Properties				
	Lint/Acre Total	Lint percent	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire
McNair 235	994	41.8	5.0	1.11	.56	22.84	6.6	4.6
Deltapine 26	992	44.5	5.0	1.09	.55	21.75	7.1	4.9
Stoneville 825	975	41.4	4.7	1.11	.54	21.31	6.7	4.6
DES 56	944	41.0	4.6	1.14	.57	22.55	7.6	4.7
DES 24	933	40.4	5.2	1.15	.56	23.20	8.1	4.6
Coker 315	916	41.1	5.4	1.17	.58	22.62	7.1	4.7
Stoneville 256	894	41.0	5.1	1.12	.56	21.31	7.0	4.9
Deltapine 55	872	42.6	4.9	1.14	.57	21.89	7.5	4.6
Deltapine 41	869	44.0	4.9	1.13	.55	21.82	7.7	4.5
Deltapine 61	865	41.6	5.2	1.12	.57	21.31	9.5	4.8
HAS 7193	847	41.6	5.2	1.15	.56	22.98	8.7	4.4
Stoneville 213	842	40.2	4.9	1.10	.54	20.15	7.8	4.7
Coker 304	836	41.4	5.2	1.18	.58	22.84	7.0	4.2
Coker 310	784	40.6	5.6	1.15	.55	22.84	6.5	4.6
LSD .05	112							

Planted: May 8, 1979
Harvested: November 1, 1979

Table 9. Results of the 1979 Cotton Variety Test on a Catalpa silty clay loam soil at Verona, Miss.

					Fiber Properties				
	Lint/Acre Total	Lint percent	Seed index	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micr nair
McNair 235	457	41.3	10.6	5.94	1.14	.58	23.42	7.2	4.9
DES 24	405	41.1	10.9	5.71	1.18	.60	22.84	8.1	4.8
DES 56	389	40.6	10.5	5.76	1.14	.57	22.11	7.7	4.7
Coker 304	383	41.3	10.7	6.21	1.19	.61	24.36	6.4	4.7
Coker 310	354	40.0	10.3	6.34	1.19	.58	23.35	6.8	4.6
Stoneville 213	353	40.0	10.6	5.90	1.12	.57	20.08	8.1	5.1
Deltapine 26	345	41.8	10.4	5.73	1.13	.57	21.16	7.7	4.8
Deltapine 55	332	42.0	10.4	5.71	1.13	.55	21.75	7.8	4.6
Deltapine 41	315	44.4	8.9	4.98	1.15	.58	22.18	7.7	4.4
Stoneville 825	312	40.4	11.3	5.70	1.15	.57	21.97	6.2	5.2
Stoneville 256	300	41.0	10.8	6.35	1.14	.57	21.10	6.3	5.3
Deltapine 61	294	39.7	11.4	6.48	1.18	.60	21.82	7.8	5.0
HAS 7193	288	39.9	12.2	6.34	1.19	.60	23.27	8.9	5.1
Coker 315	287	40.8	10.4	6.32	1.22	.61	23.79	6.7	4.7
LSD .05	59								
C.V.	13.4								

Planted: May 17, 1979
Harvested: November 5, 1979

Table 10. Results of the 1979 Cotton Variety Test on a Grenada silt loam soil at Holly Springs, Miss.

	Lint Per Acre						Fiber Properties				
			Percent			Boll	Length				
	Total	First pick	first pick	Lint percent	Seed index	size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
McNair 235	744	568	76	39.4	10.8	5.98	1.12	.61	20.24	8.0	4.3
HAS 7193	699	488	70	39.6	11.5	6.68	1.15	.60	20.69	9.6	4.5
Coker 310	692	479	69	39.9	10.2	6.36	1.17	.61	20.37	7.7	4.3
Coker 304	689	465	67	39.6	10.4	6.08	1.15	.61	19.92	8.3	4.3
DES 24	686	449	65	38.7	11.3	6.19	1.14	.58	20.21	9.2	4.5
DES 56	657	464	71	38.1	10.9	5.80	1.13	.58	18.90	9.7	4.2
Deltapine 41	655	442	67	43.2	10.7	6.21	1.11	.57	19.62	9.3	4.5
Coker 315	647	418	65	41.3	11.2	6.60	1.15	.60	20.56	8.2	4.4
Stoneville 825	645	442	68	37.5	11.0	5.91	1.10	.57	18.73	8.2	4.5
Deltapine 55	628	423	67	40.8	10.5	6.55	1.13	.57	18.15	9.4	4.4
Stoneville 213	572	356	62	36.6	10.9	6.58	1.11	.57	18.08	9.3	4.5
Stoneville 256	563	387	69	38.5	11.0	6.50	1.10	.57	18.60	7.8	4.6
Deltapine 61	507	319	63	38.4	11.8	6.72	1.13	.61	18.82	10.8	4.7
Deltapine 26	486	297	61	40.4	10.9	6.14	1.11	.57	19.10	9.6	4.5
LSD .05	74										
C.V.	15.0										

Planted: May 11, 1979
Harvested: October 24 and November 5, 1979

Table 11. Average performance of 14 cotton varieties grown in three Hill environments[1] in 1979.

	Lint/			Boll	Fiber Properties				
	Acre	Lint	Seed	size	Length		Strength	Elonga-	Micro-
	Total	percent	index	grams	2.5%	50%	g/tex	tion	naire
McNair 235	732	40.8	10.7	5.64	1.13	.58	22.16	7.3	4.6
DES 24	675	40.1	11.1	5.70	1.16	.58	22.08	8.5	4.6
DES 56	663	39.9	10.7	5.38	1.14	.57	21.18	8.4	4.5
Stoneville 825	644	39.8	11.1	5.40	1.12	.56	20.67	7.0	4.8
Coker 304	636	40.8	10.5	5.83	1.17	.60	22.37	7.2	4.4
Coker 315	617	41.0	10.8	6.11	1.18	.60	22.32	7.3	4.6
Deltapine 41	613	43.8	9.8	5.36	1.13	.57	21.20	8.2	4.5
HAS 7193	611	40.4	11.8	6.07	1.16	.59	22.31	9.1	4.7
Deltapine 55	611	41.8	10.4	5.72	1.13	.56	20.59	8.2	4.5
Coker 310	610	40.2	10.3	6.10	1.17	.58	22.18	7.0	4.5
Deltapine 26	608	42.2	10.6	5.62	1.11	.56	20.67	8.1	4.7
Stoneville 213	589	38.9	10.7	5.79	1.11	.56	19.44	8.4	4.8
Stoneville 256	586	40.1	10.9	5.98	1.12	.57	20.34	7.0	4.9
Deltapine 61	555	39.9	11.6	6.13	1.14	.59	20.65	9.4	4.8

[1] **Three environments - Holly Springs, Mississippi State, Verona.**

Table 12. Average lint yield and earliness of 11 cotton varieties at Holly Springs, Miss., 1977-79.

	1977		1978		1979		2-yr ave 1978-79		3-yr ave 1977-79	
	Lint per acre	Percent first pick	Lint per acre	Percent first pick	Lint per acre	Percent first pick	Lint per acre	Percent first pick	Lint per acre	Percent first pick
DES 56	732	75	958	64	657	71	807	68	782	70
Coker 304	664	73	948	54	689	67	819	61	767	65
Deltapine 55	667	67	991	53	628	67	810	60	762	62
DES 24	680	69	901	57	686	65	794	61	756	64
Coker 310	640	74	927	51	692	69	810	60	753	65
Stoneville 213	668	69	909	52	572	62	741	57	716	61
Stoneville 256	652	63	884	49	563	69	724	59	700	60
Stoneville 825	---	---	939	55	645	68	792	62	---	--
Deltapine 41	---	---	902	50	655	67	779	59	---	--
Coker 315	---	---	832	52	647	65	740	59	---	--
Deltapine 26	---	---	962	44	486	61	724	53	---	--

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In conformity with Title IX of the Education Amendments of 1972 and Section 504 of the Rehabilitation Act of 1973, Dr
T. K. Martin, Vice President, 610 Allen Hall, P. O. Drawer J, Mississippi State, Mississippi 39762, office telephon
number 325-3221, has been designated as the responsible employee to coordinate efforts to carry out responsibilitie
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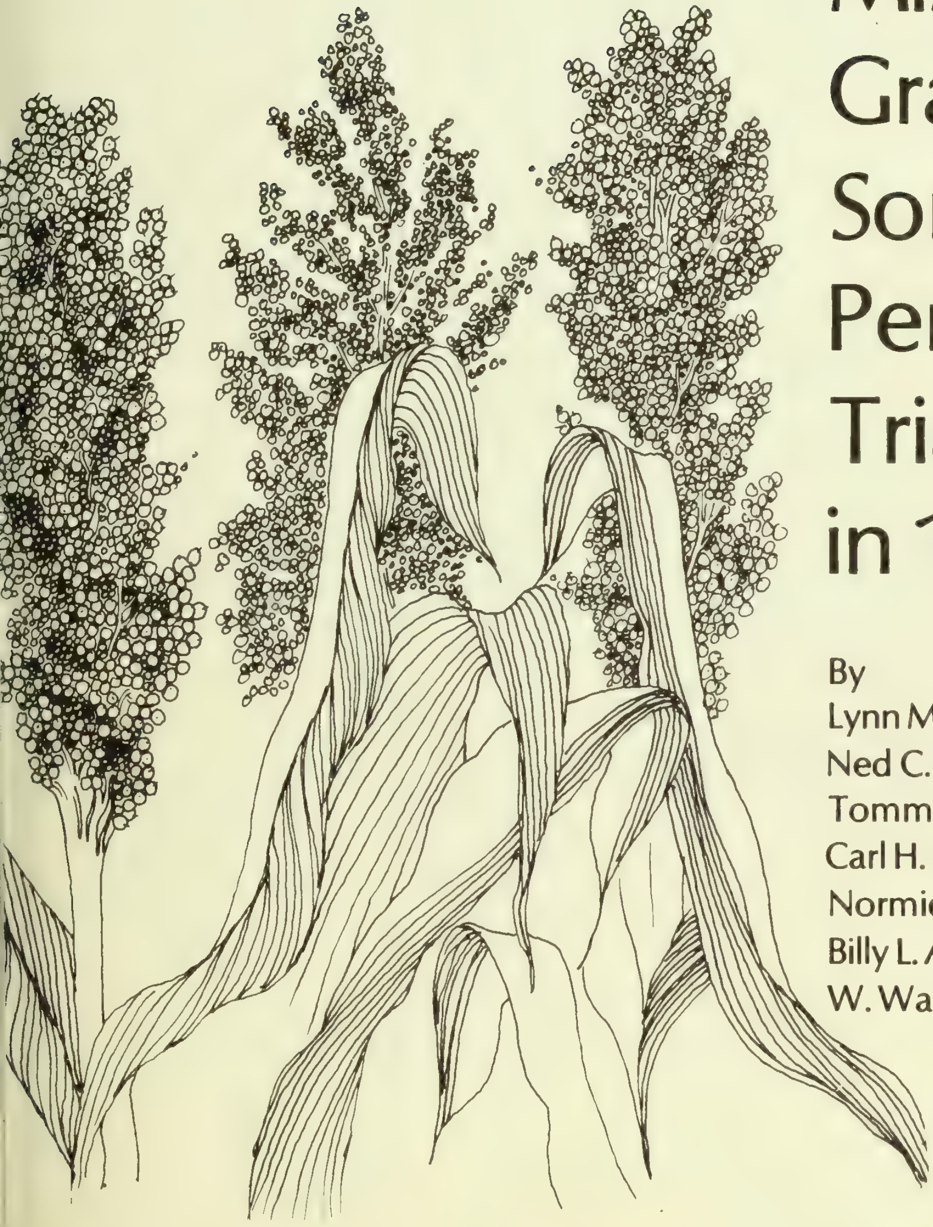

Mississippi Grain Sorghum Performance Trials in 1979

By
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Bulletin 885

Mississippi Grain Sorghum Performance Trials 1979

by

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Mississippi Agricultural and Forestry Experiment Station
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April 1980

Mississippi Grain Sorghum Performance Trials in 1979

Trials are conducted annually in Mississippi to provide farmers, seedsmen, county agents, and other interested persons with information on performance of commercially available grain sorghum hybrids. Results are particularly helpful to grain sorghum producers in selecting hybrids suited to their area.

We tested 44 commercial and experimental hybrids at six locations in Mississippi in 1979. A good test of performance cannot be made if damaging populations of insects are present; therefore, insecticides were applied as needed. See MAFES Bulletins 817 and 836 for methods of control of insects on grain sorghum.

Resistance to diseases is important in selecting a hybrid for areas where diseases are a problem. Also, planting at the recommended time helps reduce damage caused by diseases and insects.

Table 1. Planting dates, fertilizer rates (lbs/A) and insecticides applied, Hybrid Grain Sorghum Performance Trials, by location of trials, Mississippi, 1979.

Location	Planting date	Fertilizer rates[1]	Insecticides applied[2]
Mississippi State	May 8	25-25-85PP 100-0-0SD	2-diazinon
Brooksville	June 18	40-40-40PP 150-0-0SD	None
Newton	May 21	65-65-65PP 100-0-0SD	None
McNeil	May 11	160-0-0PP	2-diazinon
Holly Springs	June 12	60-70-70PP	2-sevin
Raymond	May 18	0-60-60PP 100-0-0SD	None

[1] SD = Sidedressed, PP = Preplant.

[2] Insecticides applied as labeled.

Testing Procedures

A randomized complete block design with three replications was used at all locations. Each plot consisted of two rows 38 or 40 inches wide and 20 ft long. All trials were planted at the rate of 7 lbs of seed per acre. Heads from 13 ft of each plot were hand-harvested, dried and threshed, and grain yield was adjusted to 14% moisture. Data reported have not been adjusted for bird damage, but trials severely damaged by birds were not harvested. Location of tests, planting dates, fertilizer rates and insecticides applied are presented in Table 1.

Table 2. Performance of 36 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location, 1979

Hybrid	Brand	50%[1] Bloom	Plant[2] Height	Disease[3] Fusarium	Disease[3] Bacterial stripe	Bird Damage Miss. State	Bird Damage Holly Springs	Test[2] Weight	Miss. State	Newton	McNeil	Holly Springs	Mean
		(days)	(in)	rating	rating	(%)	(%)	(lbs/bu)	lbs/A	lbs/A	lbs/A	lbs/A	lbs/A
1. M565	Pfizer	67	47	2	3	4	13	59.4	4680	7744	5164	2938	5132
2. Dinero	T-E	68	46	2	3	4	20	58.7	4731	7484	5028	2685	4982
3. R-1090	Acco	68	47	1	1	2	25	57.9	5023	6754	5233	2887	4974
4. 7737	Coker	68	47	2	2	5	17	59.0	5264	7355	4638	2127	4846
5. Two 70-D	T.T.	68	50	2	2	5	23	60.4	4748	6380	6226	1798	4788
6. 1290	G.S.A.	67	42	2	3	6	32	59.1	4800	6486	5973	1849	4777
7. ML135	G.S.A.	66	44	0	4	3	20	58.3	4542	6863	4083	3368	4714
8. 7675	Coker	68	44	0	4	5	30	58.3	4877	6129	5340	2507	4713
9. W-839DR	Warner	68	44	2	3	7	23	58.5	4937	5918	5691	2279	4707
10. Y101-D	T-E	67	45	0	4	4	27	60.5	4723	6372	5164	2279	4635
11. G-522DR	Funk's	67	44	2	3	3	27	58.4	4517	7655	4092	2127	4598
12. DR-1085	Acco	69	45	2	3	7	17	59.6	4465	6681	5340	1646	4533
13. 6658	P-A-G	66	48	3	2	2	23	60.1	4869	5520	5164	2482	4509
14. Y101-R	T-E	68	42	2	3	3	23	58.0	4147	6380	5505	2001	4508
15. 1225	Wilstar	67	45	2	3	4	25	57.7	4534	5707	5047	2710	4500
16. 8311	Pioneer	69	44	2	2	5	20	58.4	3761	5804	5466	2685	4429
17. 5504	P-A-G	67	44	2	2	5	28	58.8	4602	5276	5505	2229	4403
18. DK-64	DeKalb	67	47	2	2	7	47	60.0	4800	5301	6051	1292	4361
19. G-522	Funk's	68	43	3	4	4	22	58.5	4371	7038	3635	2355	4350
20. 1425	Wilstar	69	47	2	4	4	23	56.5	4250	5439	4648	2836	4293
21. 5514	P-A-G	68	44	1	2	4	20	57.7	4173	5057	5408	2355	4248
22. 2778	N.K.	67	43	2	3	15	13	59.0	4001	5520	5525	1849	4424
23. W-851DR	Warner	68	45	0	2	7	27	59.5	4645	5447	4930	1722	4186
24. G-622	Funk's	68	45	2	3	2	32	58.3	4250	6161	4278	2051	4185
25. M568G	Pfizer	68	43	3	3	3	17	58.3	3529	5479	5310	2254	4143
26. 733GB	R.A.	68	43	2	2	2	18	58.0	4027	4700	4930	2786	4111
27. 7638	Coker	67	42	2	3	2	15	58.1	3744	6167	4092	2406	4102
28. 2884	N.K.	69	47	0	2	15	45	59.0	4130	4895	5759	1418	4051
29. 2779	N.K.	69	43	0	4	6	20	58.1	3684	4984	5310	2077	4014
30. DR-1035	Acco	68	46	0	1	10	15	58.1	4414	5033	4258	2254	3990
31. 1330	Wilstar	68	49	1	3	18	52	57.8	3984	4927	4336	1596	3711
32. Exp3256	McNair	67	46	2	3	2	28	59.9	4577	4700	4356	1849	3871
33. E-57	DeKalb	68	47	1	4	1	67	56.2	5075	3470	5768	912	3806
34. M58G	Pfizer	66	44	2	4	3	27	57.2	3701	4367	4550	1899	3629
35. 807	R.A.	68	46	2	2	1	27	58.2	3924	4043	4375	1545	3472
36. X9140	T.T.	68	43	3	2	25	38	57.9	3649	2809	3708	1596	2941
	Mean	66	45	1.6	2.8	6	27	58.5	4393	5724	4999	2157	4323
	L.S.D.(.05)								573	1438	1386	862	---
	C.V.								8.1%	15.5%	17.2%	24.7%	---

[1] Average of Mississippi State, Newton, and Holly Springs, MS.

[2] Average of Mississippi State and Newton, MS.

[3] Rated at Meridian, MS. Rating of 0 = no disease symptoms, 4 = disease killed plants.

Table 3. Performance of eight bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location, 1979.

Hybrid	Brand	50%[1] Bloom	Plant[2] Height	Disease[3] Fusarium	Disease[3] Bacterial Stripe	Test[4] Weight	Yield Miss. State	Yield Raymond	Yield Brooksville	Yield McNeil	Yield Holly Springs	Yield Newton	Yield Mean
		(days)	(in)	rating	rating	(lbs/bu)	(lbs/A)	(lbs/A)	(lbs/A)	(lbs/A)	(lbs/A)	(lbs/A)	(lbs/A)
1. Savanna 5	N.K.	67	57	0	2	56.5	4156	3029	3039	4112	3647	7874	4310
2. B815	Pioneer	67	53	1	3	57.4	3838	3219	2907	3069	2431	6186	3608
3. G-516 BR	Funk's	68	48	1	3	56.1	3795	2869	2228	2660	3647	5723	3487
4. 7681 BR	Coker	68	48	0	3	56.5	4207	2694	2854	3128	2381	5496	3460
5. W-744 DR	Warner	67	50	1	4	56.9	4173	2316	2700	3089	2887	5074	3373
6. BR-45+	DeKalb	65	41	0	4	58.3	4199	2886	2201	2436	2760	4757	3207
7. 1334 BR	G.S.A.	69	47	1	3	54.7	3589	2364	1825	2348	3064	5301	3082
8. Two 75 BRG	T.T.	68	44	1	3	55.2	3134	1538	2435	2592	1671	3783	2526
	MEAN	67	48	.6	3	56.4	3887	2614	2523	2929	2811	5524	3382
	L.S.D.(.05)						630	855	768	675	517	1407	--
	C.V.						9.2%	18.7%	17.4%	13.2%	10.5%	14.5%	--

[1] Average of Mississippi State, Brooksville, and Newton, MS.

[2] Average of Mississippi State, Brooksville, Holly Springs, and Newton, MS.

[3] Rated at Meridian, MS. Rating of 0 = no disease symptoms - 4 = disease killed plants.

[4] Average of Mississippi State and Newton, MS.

Results

Hybrids were separated into two trials at each location, 36 non-bird-resistant hybrids in one trial (Table 2) and eight bird-resistant hybrids in the other (Table 3). Bird damage to the non-bird-resistant hybrids was recorded only at Mississippi State and Holly Springs. Bird damage of the non-bird-resistant hybrids ranged from 1 to 25% at Mississippi State, from 13 to 67% at Holly Springs and averaged 6% at Mississippi State and 27% at Holly Springs.

Lodging was negligible at all locations.

Grain yield of the 36 non-bird-resistant hybrids in the 1979 trials ranged from 912 lbs per acre for DeKalb E-57 in the Holly Springs trial to 7744 for Pfizer M565 in the Newton trial. Yields of the 36 hybrids averaged 4323 lbs per acre for the four test locations (Table 2).

Grain yield of the eight bird-resistant hybrids in the 1979 trials ranged from 1538 lbs per acre for Texas Triumph Two 75 BRG in the Raymond trial to 7874 lbs for N.K. Savanna 5 in the Newton trial. Yield of the eight hybrids averaged 3382 lbs per acre for the six test locations (Table 3).

Quantity of harvested good-quality grain (or silage) is the best guide to the desirability of sorghum hybrids; however, performance data for any one year may be misleading. Therefore, the two- and three-year average yields of hybrids that have been evaluated for these periods of time also are presented (Tables 4-7).

Table 4. Yield of 20 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for two years, 1978-79.

	Hybrid	Brand	Yields			
			Mississippi State	Newton	Holly Springs	MEAN
			lbs/A			
1.	R-1090	Acco	5710	4593	3960	4754
2.	Dinero	T-E	5522	4535	4065	4707
3.	7675	Coker	5750	4126	4214	4697
4.	G522DR	Funk's	5359	4639	4040	4679
5.	G522	Funk's	5266	4384	3947	4533
6.	ML 135	G.S.A.	5320	4146	4090	4519
7.	DR-1085	Acco	5349	4299	3830	4493
8.	7638	Coker	5196	4211	3973	4460
9.	W-839DR	Warner	5749	3759	3798	4436
10.	Two 70-D	T.T.	5395	4219	3432	4349
11.	1425	Wilstar	5404	3374	4267	4348
12.	8311	Pioneer	4593	3989	4445	4342
13.	Y-101-D	T-E	5185	4181	3308	4225
14.	1225	Wilstar	4854	3759	4046	4220
15.	G622	Funk's	5050	4137	3258	4148
16.	DR-1035	Acco	4887	3627	3755	4090
17.	Y-101-R	T-E	4520	4252	3407	4060
18.	2779	N.K.	4509	3652	3112	3758
19.	2884	N.K.	4696	3318	2830	3615
20.	1330	Wilstar	4121	3141	3457	3573
		Mean	5122	4017	3762	4300

Table 5. Yield of eight bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for two years, 1978-79.

	Hybrid	Brand	Yield					
			Mississippi State	Brooksville	Newton	Holly Springs	Raymond	MEAN
			lbs/A					
1.	Savanna 5	N.K.	4171	3723	5113	3771	4663	4288
2.	G516BR	Funk's	3554	3117	4001	3866	4596	3827
3.	B815	Pioneer	3494	3583	4317	3020	4558	3794
4.	7681BR	Coker	4057	3380	3968	3121	4401	3785
5.	BR-45+	DeKalb	3853	2915	3758	3754	4064	3669
6.	W-744DR	Warner	4058	3587	3508	2915	4068	3627
7.	1334BR	G.S.A.	3620	3099	3710	3337	4012	3555
8.	Two 75BRG	T.T.	3445	3258	3024	2846	3903	3295
		Mean	3782	3333	3925	3329	4284	3730

Table 6. Yield of 12 non-bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for three years, 1977-79.

	Hybrid	Brand	Yield			
			Mississippi State	Newton	Holly Springs	Mean
			lbs/A			
1.	R-1090	Acco	5439	4002	4418	4458
2.	G522DR	Funk's	5182	4037	3934	4384
3.	ML135	G.S.A.	5152	3642	4301	4365
4.	G522	Funk's	5101	3812	4093	4335
5.	1425	Wilstar	5161	3167	4267	4198
6.	DR-1085	Acco	5141	3823	3600	4188
7.	W-839DR	Warner	5456	3360	3591	4135
8.	8311	Pioneer	4382	3486	4434	4100
9.	1225	Wilstar	4867	3358	4048	4091
10.	Y-101-R	T-E	4415	3760	3522	3890
11.	2779	N.K.	4411	3213	3181	3602
12.	1330	Wilstar	4211	2940	3354	3502
		Mean	4910	3550	3895	4118

Table 7. Yield of six bird-resistant hybrids in Mississippi Grain Sorghum Performance Trials, by location of trials, average for three years, 1977-79.

	Hybrid	Brand	Yield Mississippi State	 Newton	 Holly Springs	 Raymond	 MEAN
			lbs/A				
1.	Savanna 5	N.K.	4235	4721	3792	4379	4282
2.	G516BR	Funk's	4065	3599	4039	3956	3915
3.	B815	Pioneer	3715	3971	3523	4068	3819
4.	1334 BR	G.S.A.	4092	3465	3824	3739	3780
5.	Two 75BRG	T.T.	3765	2797	3130	3390	3771
6.	W-744DR	Warner	4136	3249	3529	3763	3669
		Mean	4001	3633	3639	3883	3789

Hybrids Designated for Entry in the 1979 Mississippi Sorghum Performance Trials, by Sponsors.

Hybrid	Brand	Company	Address
DR 1035 DR 1085 R 1090	ACCO ACCO ACCO	ACCO Seed Company	Plainview, TX
7638 7675 7681BR 7737	Coker Coker Coker Coker	Coker's Pedigreed Seed Co.	Lubbock, TX
BR-45+ DK-64 E-57	DeKalb DeKalb DeKalb	DeKalb Ag. Research, Inc.	Lubbock, TX
ML 135 1290 1334BR	GSA GSA GSA	Growers Seed Assoc.	Lubbock, TX
1225 1330 1425	Wilstar Wilstar Wilstar	Helena Chemical Co.	Memphis, TN
G-516BR G-522 G-522DR G-662	Funk's Funk's Funk's Funk's	Louisiana Seed Co.	[illegible]
Exp 3256	McNair	McNair Seed Co.	Laurinburg, SC
Savanna 5 2778 2779 2884	NK NK NK NK	Northrup King Co.	Richardson, TX
5504 5514 6658	P-A-G P-A-G P-A-G	P-A-G Seeds	Minneapolis, MN
M58G M565 M568G	Pfizer Pfizer Pfizer	Pfizer Genetics Inc.	Cleveland, MS
B815 8311	Pioneer Pioneer	Pioneer Hi-Bred Inter., Inc.	Tipton, IN
733GB 807	RA RA	Ring Around Products, Inc.	Plainview, TX
Dinero Y101-D Y101-R	T-E T-E T-E	Taylor-Evans Seed Co.	Tulia, TX
Two 70-D Two 75BRG X9140	TT TT TT	Texas Triumph Seed Co.	[illegible]
W-744DR W-839DR W-851DR	Warner Warner Warner	George Warner's Seed Co.	[illegible]

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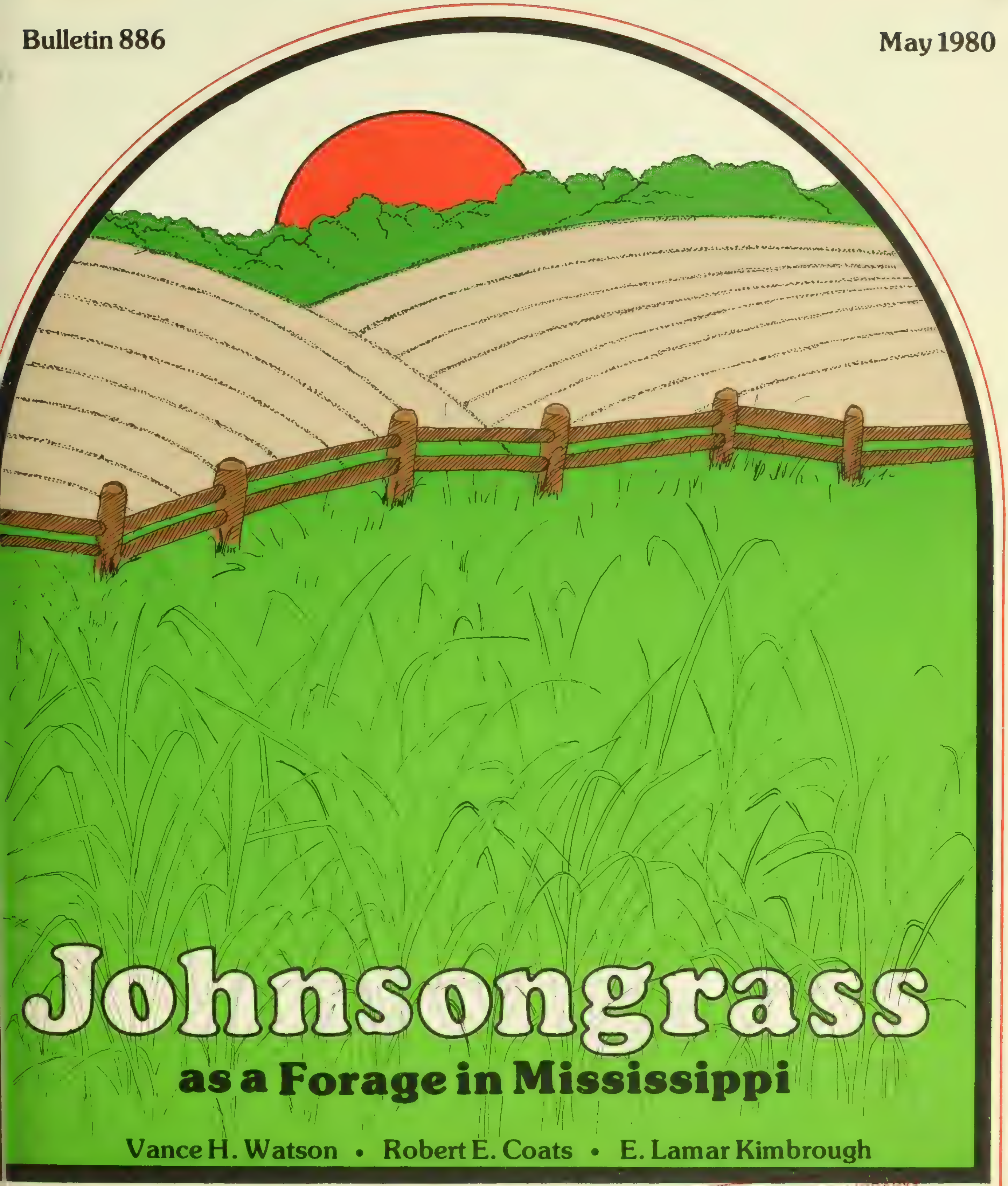

Johnsongrass

as a Forage in Mississippi

Vance H. Watson • Robert E. Coats • E. Lamar Kimbrough

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Johnsongrass as a Forage in Mississippi

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Johnsongrass
as a Forage in Mississippi

Johnsongrass [*Sorghum halepense* (L.) pers.] is native to regions that border the Mediterranean Sea from southern Asia to southern Europe. It was introduced into the United States about 1830, but documentation of its distribution was hampered by the use of more than 40 common names and eight Latin names in the 1800s (13). A Colonel Johnson brought the grass to the Black Belt of Alabama where it was named johnsongrass. It is believed to have been distributed throughout the United States by late in the 19th century and became such a pest in field crops that it led to the first federal appropriation specific to weed control. The first report on johnsongrass control was issued in 1902.

Johnsongrass still is best known as a weed in the cotton producing states. However, it is an important grazing and hay crop in the southeastern United States, and its value as pasture and hay outweighs its disadvantages in many production situations. It is particularly well adapted to the dark prairie soils of Alabama, Mississippi and Texas (Figure 1).

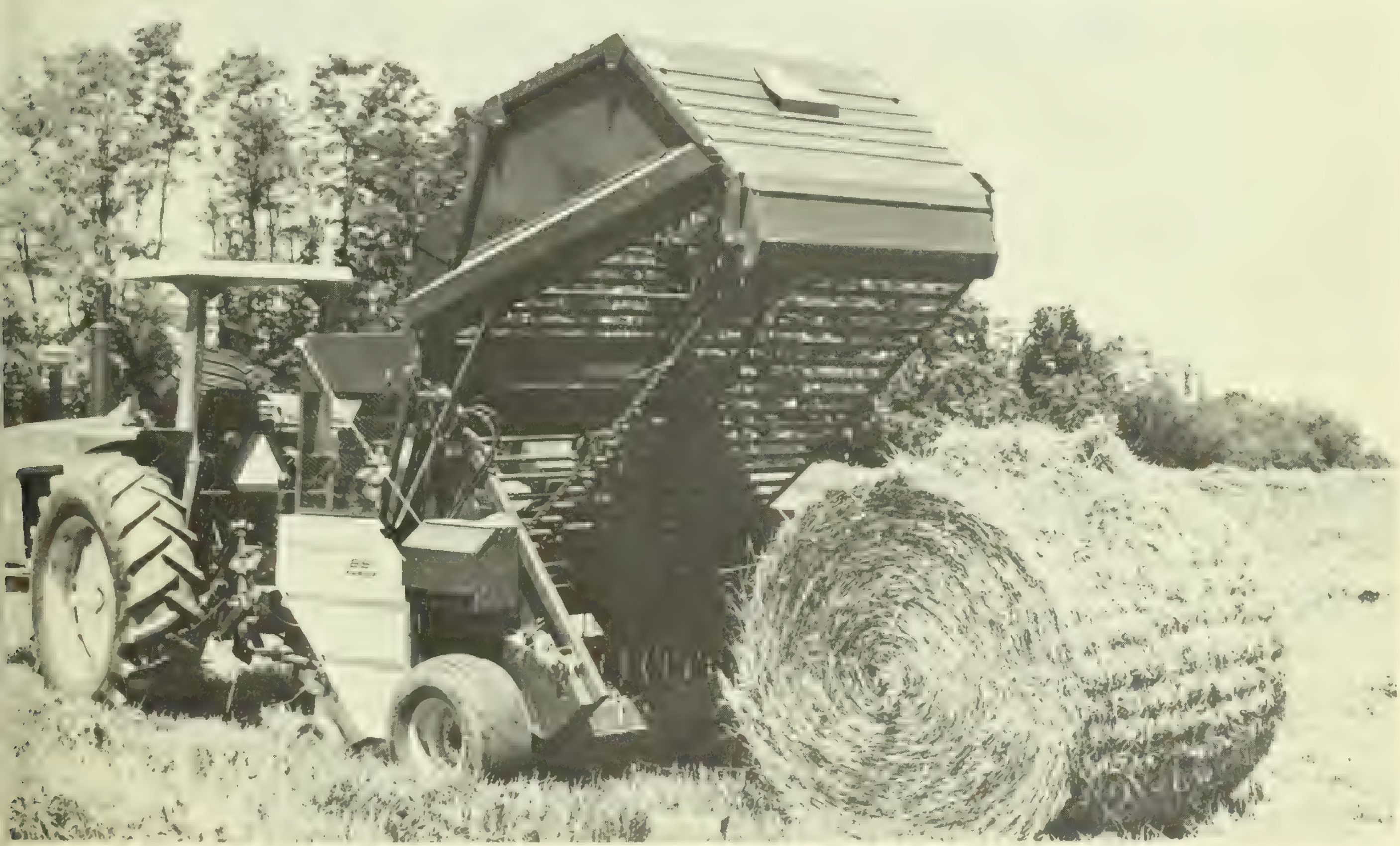

Figure 1. Johnsongrass is popular as a hay crop on the dark prairie soils of Mississippi, Alabama, and east Texas.

Value in Dairy and Beef Programs

Lusk et al. (7,8) cut johnsongrass in the boot and late milk stages of maturity and fed the hay to yearling dairy heifers for 64 days. One half of the heifers were fed the hay plus 2 lbs of a 14% protein concentrate mixture per day; the others were fed the hay plus 4 lbs of the concentrate.

Heifers fed the early-cut hay plus 2 lbs of concentrate gained at the expected 0.86 lbs/heifer/day calculated from the most generally used standards, but heifers fed the late-cut hay plus 4 lbs of concentrate gained at less than 0.86 lbs/day. Lactating cows respond more noticeably to the palatability and digestibility of the roughage portion of a ration; therefore, the researchers concluded that johnsongrass cut early for hay should give even more favorable results when fed to the milking herd.

The same researchers compared the value of johnsongrass, soybean, alfalfa and oat hays as roughage for lactating dairy cows. They concluded that alfalfa cut for hay in the 1/10 to 1/4 bloom stage was most desirable for milk production. However, johnsongrass cut in the boot stage, soybeans cut in the late bloom and oats cut in the milk stage made satisfactory hay for milk production.

Browning, Lusk and Miles (4) reported that alfalfa had proven to be the best hay tested for milk production but was not widely grown by Mississippi milk producers. Therefore, they compared the composition and digestibility of hay from johnsongrass and Coastal bermudagrass grown without fertilizer and with applications of 200-100-200 (N-P_2O_5-K_2O) to the johnsongrass and 250 or 300-150-300 (N-P_2O_5-K_2O) to Coastal.

Crude protein content and digestibility of all components were higher for hay from fertilized grass. The greatest differences were in the percentage and apparent digestibility of the crude protein fractions, both of which were about 38% higher for hay produced from fertilized grass. Voluntary consumption of hay from the fertilized Coastal was significantly greater than for hay from the less-heavily fertilized johnsongrass. The more-heavily fertilized Coastal also was higher in crude protein and protein digestibility.

Coats (5) studied the performance of beef steers on johnsongrass fertilized with different rates of N over a three-year period. Returns were lower for johnsongrass fertilized at 240 lb N/acre than at 60 or 120 lb because growth at the higher rat was much more rapid and could no be controlled or used as readily.

Hay was harvested from one hal of each pasture in 1967 in an effor to maintain quality forage over a longer period. Mowing and recover ing clippings after johnsongras reached the boot stage was no satisfactory because it forced th cattle to eat more of the remainin grass, which was of poor quality He concluded that mowing t maintain quality requires mowin several times each season to main tain the grass at a height of 8-1 inches.

Results of research with john songrass for forage in dairy an beef production systems sugges conclusions as follow:

1. Management of johnsongras for grazing will be more di ficult and animal perfo mance likely will be lowe than for other perennia grasses.
2. Production for hay should b the major use of johnsongrass.
3. Fertilizing johnsongras grown for hay increases yield and improves forage quality animal performance an stand maintenance.

Botanical Characteristics

Johnsongrass is a warm-season perennial, sod-forming species that spreads by both seed and scaly, creeping rhizomes (Figure 2). The inflorescence is an open panicle that produces abundant seed. A single seed (Figure 3) may produce a plant with from one to two or more than 170 stems, depending upon fertility, moisture, space and inherent differences (2). An average plant will initiate rhizome production at three weeks of age and will produce 20 ft of rhizomes and 4 lbs of seed in a season. Mature plants continue to produce rhizomes that grow until frost, overwinter and sprout new plants the next spring.

McWhorter (9,10,12,14) reported that 80% of the johnsongrass rhizomes produced in sandy loams and clays occurred in the top six inches of the soil. He also stated that johnsongrass in a normal growing season has three sets of rhizomes---primary, secondary and tertiary. Growth arises in spring from primary rhizomes that decay two or three weeks after growth starts. Young plants initiate growth of secondary rhizomes as the primary rhizomes decay, and growth continues until late summer. Growth of tertiary rhizomes begins in late summer. The tertiary rhizomes generally are not as large or vigorous as secondary rhizomes and usually are more rounded. They grow until frost, remain dormant throughout the winter and become primary rhizomes the next spring.

* * *

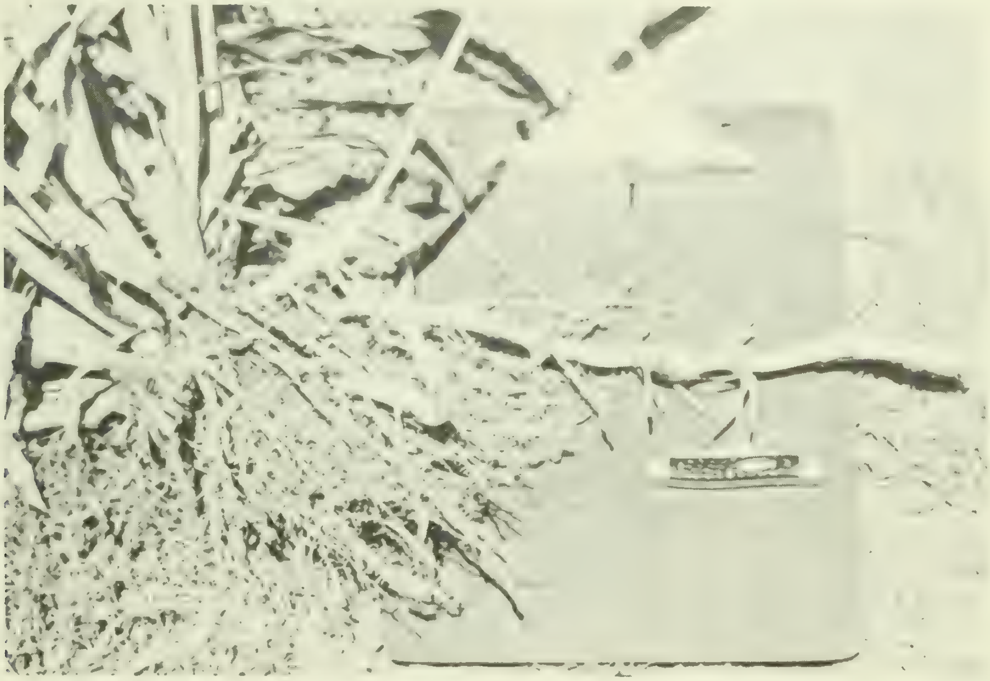

Figure 2. Johnsongrass plant showing the rhizomes that store carbohydrates for initial growth in spring and regrowth after harvest.

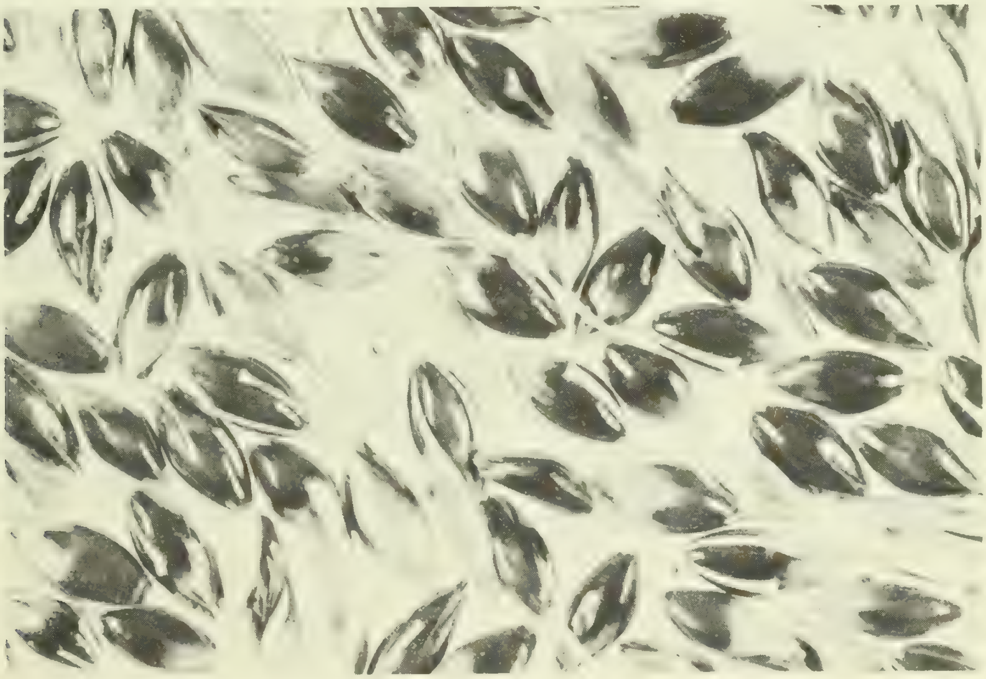

Figure 3. Johnsongrass seed are distinguished from sudangrass seed by being larger and having a cup-shaped apex.

Production Guidelines[1]

Soil Selection---Johnsongrass grows well in many soils, but does best on fertile clay loams and clays with high water-holding capacity. It will produce satisfactorily on soil with pH of 5.8 to 7.5, but optimum growth occurs in the 6.0 to 7.0 pH range. Johnsongrass-legume combinations require soil with pH of 6.0 to 7.0.

Fertilization---Apply lime, phosphate (P) and potash (K) to soil test recommendations. In the absence of a soil test, apply 120 to 160 lbs each of P_2O_5 and K_2O per acre in a 1 to 1 ratio for establishment, and go to 80 lbs/acre in a 1 to 1 ratio thereafter. An additional 60 lbs of K_2O per acre are needed each year if the crop is produced for hay only.

High rates of nitrogen (N) are required for high yields. Best results are obtained when N is applied in split applications beginning April 20 to May 1. Johnsongrass can use 1.0 to 1.3 lbs of N per acre per day; therefore, apply the equivalent of 200 to 250 lbs of ammonium nitrate per acre each second month during the growing season or after each hay clipping. Our trials have demonstrated that dry matter production increases with each increase in N up to 480 lbs/A (Table 1).

Higher rates of N also increase the crude protein content of johnsongrass (Table 2). Values obtained range from 9.4 to 13.5% for 0 to 480 lbs of N/A, respectively. The crude protein level generally considered necessary to meet maintenance requirements of a beef cow is 12%, and johnsongrass fertilized with at least 240 lbs of N/A meets this requirement.

Table 1. Dry matter production of johnsongrass fertilized with different rates of nitrogen, by location, Mississippi, 1963-1968 averages.

Nitrogen	Location		
Rate[1]	Miss. State	Prairie	Brooksville
	----------------Forage Lbs/A----------------		
0	2354 f[2]	2669 f	3030
30	3992 e	4855 e	---
60	4765 d	5500 de	4397
90	5432 d	6300 d	---
120	6658 c	8600 c	6765
240	9578 b	11000 b	7011
480	13613 a	13922 a	8146

[1] P_2O_5 and K_2O applied to each treatment at 120 lbs/A.

[2] Means in a column followed by a different letter differ significantly at the 5% level of probability as determined by Duncan's Multiple Range Test.

Table 2. Average crude protein content of johnsongrass forage produced by johnsongrass fertilized with different rates of nitrogen, Mississippi State University. 1963-1968, averages.

Nitrogen Rate	Crude Protein	
Lbs.	%	Lbs/A
0	9.43 c[1]	221 e
30	10.75 b	429 d
60	11.25 bc	536 cd
90	11.30 b	613 cd
120	11.95 ab	795 c
240	12.90 a	1235 b
480	13.50 a	1837 a

[1] Means in a column followed by a different letter differ significantly at the 5% level of probability as determined by Duncan's Multiple Range Test.

Adequate levels of P and K also are important. Phosphorous is used primarily in root production, and potassium helps to reduce winter injury and incidence of foliar diseases. These elements also affect the production and carbohydrate content of rhizomes (Table 3), and density and quality of johnsongrass stands are related directly to rhizome production. We found that rhizome production increased with increases in nitrogen application and was nearly doubled when adequate rates of P and K were supplied. Differences were not significant, but there was a trend toward higher carbohydrate levels of rhizomes where P and K were supplied.

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[1] *The guidelines presented in this bulletin are based on the latest MAFES research results available at the time of printing. Refer to the latest* **Crop and Fertilizer Guidelines for Mississippi** or consult your area or county Mississippi Cooperative Extension Service (MCES) personnel to determine whether guidelines have been changed.

Results of several years of research show that good production of pure johnsongrass or johnsongrass-legume combinations can be maintained if soil test levels of P and K are kept medium to high. A rule of thumb for N-P_2O_5-K_2O fertilization is to apply these nutrients each year in a 4-1-2 ratio for grazing and a 4-1-3 ratio for hay production.

Seedbed Preparation---Johnsongrass germinates and grows best when seeded on soil that has been leveled and firmed after tilling 4 to 6 inches deep. Some success has been obtained with seeding of johnsongrass into thin sods of other species.

Varieties and Seed Production---There are no designated varieties of johnsongrass. Texas is the major source of commercial seed, but seed can be harvested from johnsongrass grown in Mississippi.

Most seed sold in the state are obtained by machine harvest. Seed shatter readily when ripe and reported yields range from 175 to 500 lbs/A.

Johnsongrass seed are relatively dormant when first harvested, and several months may be required for after-ripening. Even then, germination is not complete except when temperature varies in a warm range (15).

Planting---Plant live seed (20-25 lbs/A) 1/2 to 3/4 inch deep between April 1 and July 1. Increase the seeding rate if the seed tag indicates low germination.

Alfalfa, red clover, wild winter peas or vetch may be seeded into johnsongrass between September 1 and October 31[2]. Grazing of interseeded areas should be deferred until spring, and the first application of N may be eliminated. Shading by the legumes will reduce early growth of the johnsongrass, and the first hay harvest may be reduced. Major considerations for adding legumes to johnsongrass sod are to provide limited forage when johnsongrass is dormant and to supply N to the johnsongrass.

Table 3. Production and carbohydrate content of rhizomes produced by johnsongrass fertilized with different rates of nitrogen, Mississippi State University, 1963-1968 averages.

Nitrogen	Rhizome Production		Rhizome Carbohydrates	
Rate	with P&K[1]	No P&K	with P&K[1]	No P&K
Lbs./A.	Lbs./A.		%	
0	257 d[2]	247 b	21.9	18.9
60	367 c	261 ab	23.8	22.9
120	447 bc	333 a	29.1	23.6
240	526 ab	314 a	28.2	20.5
480	607 a	269 a	26.1	20.0

[1] P_2O_5 and K_2O applied at 180 lbs/A of each.

[2] Means in a column followed by a different letter differ significantly at the 5% level of probability.

Table 4. Average forage production of johnsongrass and johnsongrass-legume mixtures at the MAFES Black Belt Branch, 1965-1967 averages.

Treatment	Forage Production
	LBS. DM/A
Johnsongrass Plus	
120 Nitrogen[1]	11321 c[2]
240 Nitrogen	14721 ab
Alfalfa	9208 d
Alfalfa + 120 N	13179 b
Red Clover	13305 b
Red Clover + 120 N	14867 ab
Wild Winter Peas	13815 b
Wild Winter Peas + 120 N	16057 a

[1] Nitrogen was applied at 120 and 240 pounds per acre in split applications to johnsongrass and at 120 pounds per acre to the johnsongrass plus legume plus nitrogen treatments.

[2] Means followed by a different letter differ significantly at the 5% level of probability as determined by Duncan's Multiple Range Test.

Benefits of adding alfalfa, wild winter peas or red clover to johnsongrass were evaluated over a three-year period at the MAFES Black Belt Branch, and seeding red clover or wild winter peas into johnsongrass sod increased forage production significantly over that of johnsongrass grown alone and fertilized with 120 lbs of N/A (Table 4). Also, no yield advantage

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[2] *See footnote 1.*

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Perceived Changes in Quality of Life of Open-Country Residents in Six Mississippi Counties

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SUMMARY AND CONCLUSIONS

A substantial majority of both black and white respondents in six Mississippi counties (Clay, Coahoma, Lawrence, Holmes, Neshoba and Tunica) perceived an improvement in the situations of young people, old people, blacks and the poor in their counties between 1960 and 1973. This also was true for the two overall quality of life items---quality of life for most people and of their county as a place to live.

Knowledgeables in the six counties generally agreed with household respondents that quality of life had improved. Crime and law enforcement, real income and agriculture and land use were areas where the percentage of respondents perceiving an improvement was substantially higher for knowledgeables than for household respondents. The situation was reversed for the quality of public schools and the situation and opportunities for young people, old people and blacks.

More than one half of the household respondents in seven other southern states (Alabama, Georgia, Kentucky, Louisiana, North Carolina, South Carolina and Tennessee) felt that there had been no improvements in eight quality of life categories ---all three county government items, real income, the two environment items, church and religion and recreational opportunities. The percentage of respondents expressing the belief that quality of life had improved was higher for Mississippi than for the other southern states for items that both groups felt had improved.

A majority of respondents in Mississippi rated quality of all but three items "good" in 1973. Exceptions were citizens' obedience to laws (black respondents), real income and recreational opportunities (white respondents). More than one half of the respondents in the six other southern states rated quality of six items "fair". For categories that both groups rated "good", the percentages were higher in Mississippi than in the other southern states, with the exception of the situation and opportunities for blacks.

Respondents' expressions of fears and hopes for the future provide insights into the improvements in quality of life that open-country Mississippi residents desire for their families. Concerns about how to earn money, how to get on welfare and that their ca would break down were expresse more often by blacks than b whites. Concerns about being unable to pay bills, a possible depression and a business or farm failur were expressed more often b whites than by blacks. Whites als were more concerned about th future of their children.

Hopes for economic improvement were mentioned most often b blacks and whites. Both group also ranked other hopes in th same order. Hopes for better housing, better health and better opportunities for children were expresse frequently.

Results of the study indicate tha the respondents view their qualit of life situation with some degree o accuracy. That is, their perceptio of quality of life corresponds closely to quality of life as determined b objective measures. Therefor given the limited time an resources for conducting surveys t develop subjective measures, use o objective measures of quality of lif by elected officials and other publi servants is realistic.

Perceived Changes in Quality of Life of Open-Country Residents in Six Mississippi Counties

Wolfgang Frese, associate professor and MAFES associate sociologist, Mississippi State University Department of Sociology and Rural Life

Objective measures of quality of life (e.g., income, education and employment levels) are relatively easily defined units that do not require evaluation by the individuals for whom quality of life is being assessed. Use of objective community measures assumes that quality of life of the individuals in a community improves or worsens as the objective measures improve or worsen; e.g., quality of life is considered to have improved if measures of education and health services go up and measures of unemployment and crime go down. In short, objective measures are used as proxies for the subjective experiences of individuals.

As Campbell, Converse and Rogers point out ". . .. we do not know how well objective measures like these represent underlying psychological states or how well social indicators can be taken to represent the quality of life experience."[1] Using rooms per person as an objective measure, for example, may not accurately reflect perceived quality of life because the size of a house may not coincide with the satisfaction a dweller derives from living in it.

Objective measures[2] are helpful in determining the quality of life of an individual, but a more meaningful determination requires that they be supplemented with subjective measures; i.e., what the individual perceives his (or her) quality of life to be. As W. I. Thomas pointed out: "If men define situations as real, they are real in their consequences."[3]

PURPOSE OF STUDY

Elected officials and other public servants are faced with the problem of determining where available resources can be used to serve the public interest most effectively. Decisions on how to use public funds for attaining maximum social and economic benefits can be based on experience and on objective measures of success of past and current programs. However, the ultimate political success of public programs is not what public servants perceive it to be and not what objective measures show it to be, but on what members of society perceive it to be. In short, citizens will support public programs and the public servants behind them if they believe programs are serving their needs but will mandate change if they believe they are not.

The purpose of this study was to determine quality of life as perceived by rural Mississippians. The information gained is presented as a guide to decision-makers in better identifying, understanding and alleviating conditions that foster a low level of quality of life or impede improvement in quality of life.

PROCEDURE

The six Mississippi counties included in the study were divided systematically into small-area segments,[4] and a random sample of these segments was drawn for each county.[5] Households were selected randomly from each sample segment and the household head (and/or homemaker) was interviewed. For Regional Project S-79, similar procedures were followed in Alabama, Georgia, Kentucky,

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[1] *See page 10 for explanatory notes 1-11.*

Louisiana, North Carolina, South Carolina and Tennessee.

The positional and reputational approaches were used to select local "knowledgeables" from each of the six counties. Knowledge of their county in general and of certain areas in particular (e.g., government, education, welfare) was the major criterion for their selection.[6] Not all knowledgeables selected were leaders in their county (i.e., part of the power structure), but the selection procedure assured that they were influential in their county.

SOCIOECONOMIC CHARACTERISTICS OF THE SAMPLE

All six of the Mississippi counties included in the study experienced a decline in nonwhite population, but only three---Coahoma, Holmes and Tunica---showed a similar trend in the white population (Table 1). The other three counties---Clay, Lawrence and Neshoba---actually experienced slight increases in the number of white residents. Except for Tunica County, the rural nonfarm population increased as a percentage of total population in each county, while the farm population decreased.

Median age and median family income of the population increased in the sample counties between 1960 and 1970 (Table 2). Median years of schooling of both males and females was higher in each county in 1970 than in 1960.

The 331 household respondents in the Mississippi survey were predominantly females. More than one half of all respondents were more than 50 years of age, had less than a high school education and were in low-skill jobs (Table 3). Slightly more than 40% of all respondents were retired or disabled.

Eighty-five percent of the 221 knowledgeables were white, 14% were black and 1% were Indian.[7] The majority of the knowledgeables were between 35 and 49 years of age and had occupations in the manager and proprietor categories.

Table 1. Population of the six Mississippi counties selected for Southern Regional Project, S-79, by race and place or residence , 1960 and 1970.

	Population							
County	White		Non-White		Rural Non-Farm		Rural Farm	
	1960[a]	1970[b]	1960[a]	1970[b]	1960[c]	1970[d]	1960[c]	1970[d]
	Numbers				Percent			
Clay	9,214	9,517	9,719	9,323	29.2	40.4	25.6	14.0
Coahoma	14,630	14,232	31,582	26,215	28.2	33.2	26.2	13.3
Holmes	7,595	7,345	19,501	15,775	42.7	59.0	37.2	17.3
Lawrence	6,354	7,553	3,861	3,584	67.9	81.9	32.1	18.1
Neshoba	15,026	15,091	5,901	5,711	35.0	48.6	41.0	20.7
Tunica	3,505	3,225	13,321	8,629	65.0	48.4	35.0	51.6
Mississippi	1,257,546	1,393,283	915,743	815,770	37.4	43.7	24.9	11.8

Sources:

[a] U.S. Bureau of the Census, U.S. Census of Population: 1960. General Population Characteristics Final Report PC (1)-26B Mississippi. USGPO. Washington, D.C. 1961.

[b] U.S. Bureau of the Census, U.S. Census of Population: 1970. General Population Characteristics Final Report PC (1)-B26 Mississippi. USGPO, Washington, D.C. 1971.

[c] U.S. Bureau of the Census, U.S. Census of Population: 1960. General Social and Economic Characteristics Final Report PC (1)-26C Mississippi. USGPO, Washington, D.C. 1961.

[d] U.S. Bureau of the Census, U.S. Census of Population: 1970. General Social and Economics Characteristics Final Report PC (1)-C26 Mississippi. USGPO, Washington, D.C. 1972.

Table 2. Selected Socio-Economic Characteristics of the six Mississippi counties selected for Southern Regional Project, S-79, 1960 and 1970.

County	Median Age		Median Family Income		Median of Years School Completed By Persons 25 Years Old and Older				Family with Income Less than Poverty Level	
					Males		Females			
	1960[a]	1970[b]	1960[c]	1970[d]	1960[c]	1970[d]	1960[c]	1970[d]	1960[c]	1970[d]
	- - Years - -		- - - $ - - -		- - - - - - Number - - - - - - -				- - - % - - -	
Clay	23.2	24.5	2,851	6,228	8.7	9.9	9.1	10.8	51.9	25.9
Coahoma	21.6	22.1	2,101	4,304	6.6	8.3	7.8	8.9	77.6	42.8
Holmes	21.3	23.0	1,453	3,089	6.9	8.1	8.1	8.9	77.9	53.0
Lawrence	26.2	27.0	2.422	5,049	8.4	9.9	9.0	10.6	59.6	36.6
Neshoba	27.3	29.3	2,384	5,504	8.7	9.9	9.3	10.6	50.8	29.9
Tunica	18.8	19.9	1,260	2,885	4.2	6.0	6.2	8.0	71.8	55.6
Mississippi	24.2	25.1	2,884	6,071	8.6	10.4	9.3	10.9	52.0	28.9

Sources: See Table 1.

Table 3. Selected characteristics of the Mississippi open-country household respondents selected for Southern Regional Project, S-79

	Total	Blacks	Whites
	- - - - - - - - - -	% - - - - - - - - - - -	
Sex			
Male	40	43	38
Female	60	57	62
Age			
Under 35	16.0	12.2	19.1
35 - 49	20.0	20.9	19.2
50 - 64	31.7	32.4	31.1
65+	32.3	34.5	30.6
Education			
Less than 9th Grade	55.0	81.8	33.3
Some high school	21.5	12.3	29.0
High School Diploma	12.4	3.4	19.7
1 - 4 Years of College	10.8	2.5	17.5
Master's Degree of Above	0.3	---	0.5
Occupation			
Homemaker	3.0	4.1	2.2
Farm Operator or Manager	9.7	4.7	13.7
Farm Laborer or Foreman	15.7	27.7	6.0
Manager, Proprietor (except farm, professional, technical)	1.5	---	2.7
Sales	3.0	0.7	4.9
Clerical	0.3	---	0.5
Craftsman and Foreman	3.3	---	6.0
Operatives	5.7	8.1	3.8
Service Workers	1.5	0.7	2.2
Domestic Service	1.0	2.0	---
Labor	13.6	11.5	15.3
Disabled	15.1	18.2	12.6
Retired	25.7	21.6	29.0
Unemployment	0.3	0.7	---
No Information	0.6	---	1.1
	- - - - - - - - -	Number - - - - - - -	
Total	331	148	183

PERCEIVED CHANGES IN QUALITY OF LIFE FROM 1960 to 1973

Six general dimensions or areas of quality of life were examined---county government, education, income and employment, county services, over-all quality of life, the physical environment and the quality of life of selected subpopulations (the young, the old, the poor and blacks). Only the responses of those who had lived in the county for most of the 10 years before 1973 are included in this report because respondents were asked about changes since 1960. Therefore, data are reported for only 233 respondents---106 blacks and 127 whites.[8]

Household respondents were asked whether they felt that each quality-of-life area had improved, remained about the same or worsened since 1960. A larger percentage of black respondents expressed the belief that there had been an improvement in all aspects of county government than was the case for white respondents (Table 4). Examination of the educational items indicates that a larger percentage of black respondents thought the quality of public schools had improved. There were only minor black-white differences with regard to the other two educational items.

Black-white comparisons of the income and employment items indicate that a majority of blacks felt that real income had improved while a majority of whites did not. About the same percentages of blacks and whites felt that incomes of people who work for wages had improved, and a larger percentage of whites felt that employment opportunities had improved. The percentage of respondents expressing the belief that the agriculture and land use situation had improved was higher for whites than for blacks, while a larger percentage of blacks felt that quality of the physical environment had improved.

Table 4. Changes in quality of life as perceived by black and white open-country residents of Clay, Coahoma, Holmes, Lawrence, Neshoba and Tunica counties, Mississippi, by quality of life item, 1960 to 1973.

Quality of Life Item	Type of Perceived Change Between 1960 and 1973					
	Improved		Remained the Same		Gotten Worse	
	%	No.	%	No.	%	No.
COUNTY GOVERNMENT						
Quality of county government						
Blacks	77.8	(77)	18.2	(18)	4.0	(4)
Whites	61.4	(70)	28.9	(33)	9.7	(11)
Politics and political parties						
Blacks	76.7	(69)	20.0	(18)	3.3	(3)
Whites	50.5	(50)	32.3	(32)	17.2	(17)
Crime and law enforcement						
Blacks	64.0	(64)	22.0	(22)	14.0	(14)
Whites	44.1	(52)	26.3	(31)	29.6	(35)
EDUCATION						
Quality of public schools						
Blacks	86.0	(80)	11.8	(11)	2.2	(2)
Whites	53.8	(56)	8.7	(9)	37.5	(39)
Quality of private schools						
Blacks	84.3	(59)	12.8	(9)	2.9	(2)
Whites	90.1	(82)	7.7	(7)	2.2	(2)
Opportunities for education and training beyond high school						
Blacks	92.5	(87)	7.5	(7)	0.0	(0)
Whites	85.7	(96)	11.6	(13)	2.7	(3)
INCOME AND EMPLOYMENT						
Real income						
Blacks	62.8	(59)	14.9	(14)	22.3	(21)
Whites	40.3	(46)	16.7	(19)	43.0	(49)
Income for people who work for wages						
Blacks	88.2	(91)	10.7	(11)	0.1	(1)
Whites	89.9	(107)	7.6	(9)	2.5	(3)
Employment opportunities in the county						
Blacks	74.5	(76)	17.7	(18)	7.8	(8)
Whites	84.5	(98)	11.2	(13)	4.3	(5)
ENVIRONMENT						
Agriculture and land use situation						
Blacks	61.9	(60)	13.4	(13)	24.7	(24)
Whites	69.9	(79)	15.9	(18)	14.2	(16)
Quality of the physical environment						
Blacks	77.4	(65)	16.7	(14)	5.9	(5)
Whites	61.3	(65)	28.3	(30)	10.4	(11)
SERVICES						
Quality of roads and transportation system						
Blacks	83.5	(86)	14.6	(15)	1.9	(2)
Whites	84.1	(106)	12.7	(16)	3.2	(4)
Public utilities						
Blacks	88.0	(88)	12.0	(12)	0.0	(0)
Whites	81.0	(98)	18.2	(22)	0.8	(1)
Quality of medical care and health services						
Blacks	90.4	(94)	5.8	(6)	3.8	(4)
Whites	75.6	(93)	11.4	(14)	13.0	(16)
Quality of church and religion						
Blacks	60.8	(62)	24.5	(25)	14.7	(15)
Whites	56.5	(69)	32.0	(39)	11.5	(14)
Welfare programs						
Blacks	86.1	(87)	9.9	(10)	4.0	(4)
Whites	80.0	(84)	9.5	(10)	10.5	(11)
Effectiveness of government housing programs						
Blacks	90.0	(90)	8.0	(8)	2.0	(2)
Whites	87.5	(98)	10.7	(12)	1.8	(2)
Recreational opportunities						
Blacks	58.6	(51)	36.8	(32)	4.6	(4)
Whites	54.1	(60)	38.7	(43)	7.2	(8)
SUBPOPULATIONS						
Situation and opportunities for young people						
Blacks	91.1	(93)	7.8	(8)	0.1	(1)
Whites	82.2	(97)	16.1	(19)	1.7	(2)
Situation and opportunities for old people						
Blacks	86.5	(90)	10.6	(11)	2.9	(3)
Whites	68.3	(84)	26.0	(32)	5.7	(7)
Quality of life for the poor						
Blacks	82.7	(86)	12.5	(13)	4.8	(5)
Whites	90.1	(109)	7.4	(9)	2.5	(3)
Situation and opportunities for blacks						
Blacks	94.2	(98)	3.9	(4)	1.9	(2)
Whites	98.4	(118)	0.8	(1)	0.8	(1)
OVER-ALL QUALITY OF LIFE						
Quality of life for most people						
Blacks	76.4	(81)	17.9	(19)	5.7	(6)
Whites	81.9	(104)	8.7	(11)	9.4	(12)
County as a place to live						
Blacks	89.4	(93)	10.6	(11)	0.0	(0)
Whites	83.0	(103)	14.5	(18)	12.5	(3)

Table 5. Changes in quality of life as perceived by open-country residents and knowledgeables of Clay, Coahoma, Holmes, Lawrence, Neshoba and Tunica counties, Mississippi by quality of life item, 1960 to 1973.

Quality of Life Item	Type of Perceived Change Between 1960 and 1973					
	Improved		Remained the Same		Gotten Worse	
	%	No.	%	No.	%	No.
COUNTY GOVERNMENT						
Quality of county government						
Household respondents	69.0	(147)	23.9	(51)	7.1	(15)
Knowledgeables	49.1	(108)	50.0	(110)	0.9	(2)
Politics and political parties						
Household respondents	63.0	(119)	26.4	(50)	10.6	(20)
Knowledgeables	61.9	(135)	34.9	(76)	3.2	(7)
Crime and law enforcement						
Household respondents	53.2	(116)	24.3	(53)	22.5	(49)
Knowledgeables	74.7	(165)	23.1	(51)	2.2	(5)
EDUCATION						
Quality of public schools						
Household respondents	69.0	(136)	10.2	(20)	20.8	(41)
Knowledgeables	50.2	(111)	10.0	(22)	39.8	(88)
Opportunities for education and training beyond high school						
Household respondents	88.8	(183)	9.7	(20)	1.5	(3)
Knowledgeables	91.7	(200)	7.3	(16)	1.0	(2)
INCOME AND EMPLOYMENT						
Real income						
Household respondents	50.5	(105)	15.9	(33)	33.6	(70)
Knowledgeables	70.6	(156)	27.6	(61)	1.8	(4)
Employment opportunities in the county						
Household respondents	79.8	(174)	14.2	(31)	6.0	(13)
Knowledgeables	80.0	(176)	14.5	(32)	5.5	(12)
ENVIRONMENT						
Agriculture and land use situation						
Household respondents	66.2	(139)	14.8	(31)	19.0	(40)
Knowledgeables	86.2	(187)	10.6	(23)	3.2	(7)
Quality of the physical environment						
Household respondents	68.4	(130)	23.2	(44)	8.4	(16)
Knowledgeables	20.0	(44)	63.6	(140)	16.4	(36)
SERVICES						
Quality of roads and transportation system						
Household respondents	83.8	(192)	13.6	(31)	2.6	(6)
Knowledgeables	85.0	(187)	11.8	(26)	3.2	(7)
Public utilities						
Household respondents	84.2	(186)	15.4	(34)	0.4	(1)
Knowledgeables	87.7	(192)	11.4	(25)	0.9	(2)
Quality of medical care and health services						
Household respondents	82.4	(187)	8.8	(20)	8.8	(20)
Knowledgeables	84.6	(187)	14.5	(32)	0.9	(2)
Quality of church and religion						
Household respondents	58.4	(131)	28.6	(64)	13.0	(29)
Knowledgeables	31.2	(67)	65.6	(141)	3.3	(7)
Welfare programs						
Household respondents	83.0	(171)	9.7	(20)	7.3	(15)
Knowledgeables	81.0	(175)	11.1	(24)	7.9	(17)
Recreational opportunities						
Household respondents	56.0	(111)	37.9	(75)	6.1	(12)
Knowledgeables	56.4	(124)	32.3	(71)	11.3	(25)
SUBPOPUALTIONS						
Situation and opportunities for young people						
Household respondents	86.4	(190)	12.3	(27)	1.3	(3)
Knowledgeables	70.5	(155)	26.8	(59)	2.7	(6)
Situation and opportunities for old people						
Household respondents	76.7	(190)	18.9	(43)	4.4	(10)
Knowledgeables	63.2	(139)	35.4	(78)	1.4	(3)
Quality of life for the poor						
Household respondents	86.7	(195)	9.8	(22)	3.5	(8)
Knowledgeables	88.4	(190)	8.8	(19)	2.8	(6)
Situation and opportunities for blacks						
Household respondents	96.5	(216)	2.2	(5)	1.3	(3)
Knowledgeables	82.3	(182)	14.5	(32)	3.2	(7)
OVER-ALL QUALITY OF LIFE						
Quality of life for most people						
Household respondents	79.4	(185)	12.9	(30)	7.7	(18)
Knowledgeables	96.8	(214)	2.3	(5)	0.9	(2)

Most respondents indicated that ounty services had improved. here were no major differences in pinions of blacks and whites xcept for medical service and ealth care.

A substantial majority of both lack and white respondents elieved there had been an imrovement in the situations of oung people, old people, blacks nd the poor. This also was true for he two overall quality of life items--quality of life for most people and f their county as a place to live. Black-white differences for the ubpopulations and overall quality f life items were not very large, xcept for situations and opporunities for old people---more than 86% of the blacks stated that the ituation had improved while only about 68% of the whites responded ositively.

Knowledgeables generally agreed with household respondents [9,10] that quality of life had improved. However, less than 50% of the knowledgeables believed there had been improvement in quality of county government, the physical environment and church and religion (Table 5).

Crime and law enforcement, real income and agriculture and land use were areas where the percentage of respondents perceiving an improvement was substantially higher for knowledgeables than for household respondents. The situation was reversed for the quality of public schools and the situation and opportunities for young people, old people and blacks.

More than one half of the household respondents in the other southern states felt that eight items had not improved---all three county government items, real income, the two environment items, church and religion and recreational opportunities (Table 6). The percentage of respondents expressing the belief that quality of life had improved was higher for Mississippi than for the other southern states, for all items.

PERCEPTIONS OF QUALITY OF LIFE IN 1973

A majority of respondents in Mississippi rated quality of all but three items "good" in 1973. Exceptions were citizens obedience of laws (black respondents), real income and recreational opportunities (white respondents). The quality of life of the various subgroups also was rated "good" by a majority of both black and white respondents, the one exception being the situation and opportunities for blacks (Table 7).

More than one half of the respondents in the seven other southern states rated the quality of six categories as only "fair" in 1973---all three county government items, real income, the agricultural and land use situation and recreational opportunities (Table 8). For categories that a majority of both groups rated "good", the percentages were higher in Mississippi than in the other southern states, with the exception of the situation and opportunities for blacks.

FEARS AND HOPES OF MISSISSIPPI RESPONDENTS[11]

The S-79 project was not designed to determine respondents' perceptions of future changes in quality of life in their county; however, household respondents were asked to express their fears and hopes for the future of their families. The results provide insights into the improvements in

Table 6. Changes in quality of life as perceived by open-country residents of Mississippi and of seven other Southern States,* by quality of life item, 1960-1973.

	Type of the Perceived Change Between 1960 and 1973					
	Improved		Remained the Same		Gotten Worse	
Quality of Life Item	%	No.	%	No.	%	No.
COUNTY GOVERNMENT						
Quality of county government						
Mississippi	69.0	(147)	23.9	(51)	7.1	(14)
Other states	35.0	(486)	47.5	(658)	17.5	(242)
Politics and political parties						
Mississippi	63.0	(119)	26.4	(50)	10.6	(20)
Other states	23.6	(299)	51.9	(658)	24.5	(311)
Crime and law enforcement						
Mississippi	53.2	(116)	24.3	(53)	22.5	(49)
Other states	29.2	(438)	35.4	(532)	35.4	(532)
EDUCATION						
Quality of public schools						
Mississippi	69.0	(136)	10.2	(20)	20.8	(41)
Other states	58.0	(848)	13.1	(191)	28.9	(422)
Quality of private schools						
Mississippi	87.6	(141)	9.9	(16)	2.5	(4)
Other states	74.8	(255)	16.7	(57)	8.5	(29)
Opportunities for education and training beyond high school						
Mississippi	88.8	(183)	9.7	(20)	1.5	(3)
Other states	81.9	(1192)	14.9	(216)	3.2	(47)
INCOME AND EMPLOYMENT						
Real income						
Mississippi	50.5	(105)	15.9	(33)	33.6	(70)
Other states	34.3	(499)	28.2	(410)	37.5	(545)
Income for people who work for wages						
Mississippi	89.2	(198)	9.0	(20)	1.8	(4)
Other states	81.9	(1255)	14.2	(218)	3.9	(59)
Employment opportunities in the county						
Mississippi	79.8	(174)	14.2	(31)	6.0	(13)
Other states	69.8	(1069)	18.6	(284)	11.6	(178)
ENVIRONMENT						
Agriculture and land use situation						
Mississippi	66.2	(139)	14.8	(31)	19.0	(40)
Other states	47.3	(620)	24.8	(325)	27.9	(366)
Quality of the physical environment						
Mississippi	68.4	(130)	23.2	(44)	8.4	(16)
Other states	31.9	(447)	45.2	(633)	22.9	(321)
SERVICES						
Quality of roads and transportation system						
Mississippi	83.8	(192)	13.6	(31)	2.6	(6)
Other states	75.6	(1204)	14.9	(237)	9.5	(152)
Public utilities						
Mississippi	84.2	(186)	15.4	(34)	0.4	(1)
Other states	74.0	(1080)	20.3	(296)	5.7	(84)
Quality of medical care and health services						
Mississippi	82.4	(187)	8.8	(20)	8.8	(20)
Other states	61.9	(956)	19.5	(302)	18.6	(287)
Quality of church and religion						
Mississippi	58.4	(131)	28.6	(64)	13.0	(29)
Other states	40.7	(604)	39.9	(592)	19.4	(289)
Welfare programs						
Mississippi	83.0	(171)	9.7	(20)	7.3	(15)
Other states	58.1	(717)	20.4	(251)	21.5	(265)
Effectiveness of government housing program						
Mississippi	88.7	(188)	9.4	(20)	1.9	(4)
Other states	80.2	(1045)	13.0	(169)	6.8	(89)
Recreational opportunities						
Mississippi	56.0	(111)	37.9	(75)	6.1	(12)
Other states	47.5	(655)	36.3	(500)	16.2	(224)
SUBPOPULATIONS						
Situation and opportunities for young people						
Mississippi	86.4	(190)	12.3	(27)	1.3	(3)
Other states	63.9	(969)	22.9	(347)	13.2	(201)
Situation and opportunities for old people						
Mississippi	76.7	(174)	18.9	(43)	4.4	(10)
Other states	55.7	(840)	31.4	(474)	12.9	(195)
Quality of life for the poor						
Mississippi	86.7	(195)	9.8	(22)	3.5	(8)
Other states	69.3	(1038)	21.0	(314)	9.7	(145)
Situation and opportunities for blacks						
Mississippi	96.5	(216)	2.2	(5)	1.3	(3)
Other states	84.9	(1074)	11.9	(150)	3.2	(41)
OVER-ALL QUALITY OF LIFE						
Quality of life for most people						
Mississippi	79.4	(185)	12.9	(30)	7.7	(18)
Other states	69.5	(1122)	18.5	(299)	12.0	(194)
County as a place to live						
Mississippi	86.0	(196)	12.7	(29)	1.3	(3)
Other states	72.4	(1134)	23.5	(369)	4.1	(64)

*Alabama, Georgia, Kentucky, Louisiana, North Carolina, South Carolina, Tennessee.

uality of life that open-country lississippi residents desire for heir families.

No fears were expressed by 108 37.5%) of the 288 interviewees who esponded. Fears were expressed y 87 (65.9%) of the black espondents and 93 (59.6%) of the vhite respondents. The 87 blacks nentioned 111 fears. The 93 whites nentioned 93 fears (Table 9).

Economic fears (concerns about ıow to earn money, how to get on velfare and that their car would reak down) were mentioned most ften by blacks, followed by fears bout their children and about amily health (Table 9). Health ears were mentioned most often by vhites, followed very closely by conomic fears (concern about eing unable to pay bills, a possible lepression and a business or farm ailure).

No hopes were expressed by 56 17.9%) of the 312 interviewees who esponded to this question. Hopes vere expressed by 114 (83.2%) of the lack respondents and 142 (81.2%) f the white respondents. The 114 lacks mentioned 189 hopes. The 42 whites mentioned 164 hopes Table 10).

The rank order of hopes was the ame for blacks and whites. Hopes for economic improvement vere mentioned most often, followd by hopes for better housing, etter health and better opporunities for children.

Table 7. Rating of quality of life in 1973 by black and white residents of Clay, Coahoma, Holmes, Lawrence, Neshoba and Tunica counties, Mississippi, by quality of life item.

	Current Rating[1]			
	Fair		Good	
Quality of Life Item	%	No.	%	No.
COUNTY GOVERNMENT				
Quality of county government				
Blacks	33.0	(32)	67.0	(65)
Whites	42.0	(47)	58.0	(65)
Politics and political parties				
Blacks	42.4	(38)	57.8	(52)
Whites	38.4	(38)	61.6	(61)
Citizens' obedience of laws				
Blacks	61.1	(63)	38.9	(40)
Whites	47.8	(56)	52.2	(61)
EDUCATION				
Quality of public schools				
Blacks	18.3	(17)	81.7	(76)
Whites	39.0	(39)	61.0	(61)
Quality of private schools				
Blacks	19.1	(13)	80.9	(55)
Whites	6.5	(6)	93.5	(86)
Opportunities for education and training beyond high school				
Blacks	17.0	(16)	83.0	(78)
Whites	19.0	(21)	81.0	(89)
INCOME AND EMPLOYMENT				
Real income				
Blacks	49.4	(46)	50.6	(47)
Whites	62.6	(72)	37.4	(43)
Income for people who work for wages				
Blacks	30.1	(31)	69.9	(72)
Whites	20.5	(24)	79.5	(93)
Employment opportunities in the county				
Blacks	42.1	(43)	57.9	(59)
Whites	22.6	(26)	77.4	(89)
ENVIRONMENT				
Agricultural and land use situation				
Blacks	40.2	(39)	59.8	(58)
Whites	29.2	(33)	70.8	(80)
Quality of the physical environment				
Blacks	31.0	(26)	69.0	(58)
Whites	26.7	(28)	73.3	(77)
SERVICES				
Quality of roads and transportation system				
Blacks	38.4	(40)	61.6	(64)
Whites	27.8	(35)	72.2	(91)
Public utilities				
Blacks	28.0	(28)	72.0	(72)
Whites	16.5	(20)	83.5	(101)
Quality of medical care and health services				
Blacks	17.8	(18)	82.2	(83)
Whites	21.9	(27)	78.1	(96)
Quality of church and religion				
Blacks	34.3	(35)	65.7	(67)
Whites	15.7	(19)	84.3	(102)
Welfare programs				
Blacks	28.7	(29)	71.3	(72)
Whites	31.5	(33)	68.5	(72)
Effectiveness of government housing program				
Blacks	27.0	(27)	73.0	(73)
Whites	16.2	(18)	83.8	(93)
Recreational opportunities				
Blacks	31.0	(27)	69.0	(60)
Whites	53.2	(59)	46.8	(52)
SUBPOPULATIONS				
Situation and opportunities for young people				
Blacks	27.5	(28)	72.5	(74)
Whites	26.2	(31)	73.8	(87)
Situation and opportunities for old people				
Blacks	43.3	(45)	56.7	(59)
Whites	43.9	(54)	56.1	(69)
Situation and opportunities for blacks				
Blacks	51.9	(54)	48.1	(50)
Whites	13.4	(16)	86.6	(103)
OVER-ALL QUALITY OF LIFE				
County as a place to live				
Blacks	32.7	(34)	67.3	(70)
Whites	14.5	(18)	85.5	(106)

[1] "Fair" and "Poor" responses are combined into one Fair category while the "Good" and "Very Good" responses are combined into the Good category.

Table 8. Rating of quality of life in 1973 by open-country residents of Mississippi and of seven other Southern States*, by quality of life item.

Quality of Life Item	Current Rating			
	Fair		Good	
	%	No.	%	No.
COUNTY GOVERNMENT				
Quality of county government				
Mississippi	37.8	(79)	62.2	(130)
Other states	59.0	(822)	41.0	(570)
Politics and political parties				
Mississippi	40.2	(76)	59.8	(113)
Other states	67.4	(857)	32.6	(414)
Citizens' obedience of laws				
Mississippi	54.0	(119)	46.0	(101)
Other states	57.2	(861)	42.8	(644)
EDUCATION				
Quality of public schools				
Mississippi	29.0	(56)	71.0	(137)
Other states	41.8	(608)	58.2	(848)
Quality of private schools				
Mississippi	11.9	(19)	88.1	(141)
Other states	30.1	(115)	69.9	(268)
Opportunities for education and training beyond high school				
Mississippi	18.1	(37)	81.9	(167)
Other states	26.1	(377)	73.9	(1063)
INCOME AND EMPLOYMENT				
Real income				
Mississippi	56.7	(118)	43.3	(90)
Other states	66.7	(953)	33.7	(484)
Income for people who work for wages				
Mississippi	25.0	(55)	75.0	(165)
Other states	35.4	(532)	64.6	(971)
Employment opportunities in the county				
Mississippi	31.8	(69)	68.2	(148)
Other states	45.4	(691)	54.6	(832)
ENVIRONMENT				
Agricultural and land use situation				
Mississippi	34.3	(72)	65.7	(138)
Other states	51.0	(661)	49.0	(635)
Quality of the physical environment				
Mississippi	28.6	(54)	71.4	(135)
Other states	44.4	(616)	55.6	(772)
SERVICES				
Quality of roads and transportation system				
Mississippi	32.6	(75)	67.4	(155)
Other states	37.5	(592)	62.5	(985)
Public utilities				
Mississippi	21.7	(48)	78 3	(173)
Other states	32.8	(473)	67.2	(968)
Quality of medical care and health services				
Mississippi	20.1	(45)	79.9	(179)
Other states	41.6	(643)	58.4	(902)
Quality of church and religion				
Mississippi	24.2	(54)	75.8	(169)
Other states	42.1	(620)	57.9	(850)
Welfare programs				
Mississippi	30.1	(62)	69.9	(144)
Other states	45.9	(571)	54.1	(673)
Effectiveness of government housing program				
Mississippi	21.3	(45)	78.7	(166)
Other states	33.5	(421)	66.5	(835)
Recreational opportunities				
Mississippi	43.5	(86)	56.5	(112)
Other states	60.1	(819)	39.9	(544)
SUBPOPULATIONS				
Situation and opportunities for young people				
Mississippi	26.8	(59)	73.2	(161)
Other states	47.0	(706)	53.0	(797)
Situation and opportunities for old people				
Mississippi	43.6	(99)	56.4	(128)
Other states	48.7	(729)	51.3	(768)
Situation and opportunities for blacks				
Mississippi	31.4	(70)	68.6	(153)
Other states	25.6	(318)	74.4	(923)
OVER-ALL QUALITY OF LIFE				
County as a place to live				
Mississippi	22.8	(52)	77.2	(176)
Other states	24.0	(374)	76.0	(1186)

*See footnote, Table 6.

Table 9. Expressed fears of 87 black and 93 white open-country residents of Clay, Coahoma, Holmes, Lawrence, Neshoba and Tunica counties, Mississippi, 1973

Type of Fear	Frequency of Expression					
	Total Sample		Blacks		Whites	
	%	No.	%	No.	%	No.
Economic	34.2	(70)	37.0	(41)	31.2	(29)
Health	27.0	(55)	21.6	(24)	33.3	(31)
Children	23.5	(48)	27.9	(31)	18.3	(17)
Crime	4.9	(10)	2.7	(3)	7.5	(7)
Other	10.3	(21)	10.8	(12)	9.7	(9)
Total Fears Mentioned	100.0	(204)	100.0	(111)	100.0	(93)

Table 10. Expressed hopes of 114 black and 142 white open-country residents of Clay, Coahoma, Holmes, Lawrence, Neshoba and Tunica counties, Mississippi, 1973

Type of Hope	Frequency of Expression					
	Total Sample		Blacks		Whites	
	%	No.	%	No.	%	No.
Economic	26.4	(93)	28.6	(54)	23.8	(39)
Housing	21.2	(75)	20.1	(38)	22.6	(37)
Health	20.7	(73)	20.1	(38)	21.3	(35)
Children	18.1	(64)	19.6	(37)	16.5	(27)
Religion	7.7	(27)	6.3	(12)	9.1	(15)
Other	5.9	(21)	5.3	(10)	6.7	(11)
Total Hopes Mentioned	100.0	(353)	100.0	(189)	100.0	(164)

[1] *Campbell, Angus, Philip E. Converse and Willard L. Rodgers, The Quality of American* ***Life*** Sage Foundation: New York, 1976. p. 3.

[2] *See Preface for objective quality of life reports for Mississippi.*

[3] *W. I. Thomas, The Unadjusted Girl,* Harper and Row, Publishers: New York, 1967. p. xii.

[4] *These segments had been selected for the S-44 project, a predecessor of the S-79 project. For a more detailed discussion of the sampling procedure, see "Sampling Design for the Regional Rural Sociology Project, S-44" unpublished paper, Department of Statistics, North Carolina State University, Raleigh, Spring, 1960.*

[5] *For further information on the sampling procedure, see, for example: A. L. Coleman, C. M. Coughenour, A. V. Gabbard and D. Zeirath, "Rural Development and the Quality of Life in Harlan, Perry, Whitley and Wolfe Counties: Summaries of Data from Surveys of Households in 1961 and 1973;" mimeographed papers, Department of Sociology, University of Kentucky, December, 1973; H. G. Pieper, N. A. Holt and H. M. Miller "Perceptions of Quality of Life in Open-Country Areas: A Case Study," published in Rural Sociology in the South: 1974,* Proceedings (Rural Sociology Section) Southern Association of Agricultural Scientists, Memphis, Tennessee, February, 1974.

[6] *For more details on the selection of knowledgeables, see: Tatree Nontasak, "Community Knowledgeables' Attitudes Concerning Changes in Selected Socioeconomic Activities of Certain Counties` in Mississippi," unpublished Masters thesis, Department of Sociology and Rural Life, Mississippi State University, Mississippi State, Mississippi, December 1973, pp. 24-29; Gerald O. Windham and Tatree Nontasak, "Attitudes of Knowledgeables Toward Community Change," published in Rural Sociology in the South: 1974, Proceedings (Rural Sociology Section) of the Southern Association of Agricultural Scientists, Memphis, Tennessee, February 1974; and Virginia Steelman, "Knowledgeables' Opinions of Changes in the Quality of Life in Twenty-six Southern Counties, 1960-1972: S-79 Regional Research Project," published in Rural Sociology in the South: 1975,* Proceedings (Rural Sociology Section) of the Southern Association of Agricultural Scientists, Memphis, Tennessee, February 1974.

[7] *Although one of the Mississippi counties contained an Indian Reservation and some of the knowledgeables from that county are Indians, there were no Indians in the Mississippi household sample. It should be noted that Indian reservations were not included in the S-79 sampling universe.*

[8] *The actual household respondent interviewing started in 1972 and continued into 1973. For ease of presentation we will refer to it as 1973 data.*

[9] *Answers for four of the items elicited from the household respondents were not obtained from the knowledgeables (namely, the quality of private schools, the income for people who work for wages, county as a place to live, and the effectiveness of the government housing programs) so of necessity these are excluded from our analysis.*

[10] *For a comparison of black and white household respondents' and knowledgeables' perceptions of changes in the quality of life using Mississippi S-79 data see: Tatree Nontasak and Wolfgang Frese "Perceptions About Changes in the Quality of Life in Rural Mississippi: A Comparison Between Knowledgeables and Household Respondents" published in Rural Sociology in the South: 1975* the Proceedings (Rural Sociology Section) of the Annual Meeting of the Southern Association of Agricultural Scientists, New Orleans, Louisiana, February, 1975.

[11] *It should be noted that using family hopes and fears to estimate the situation in the county must be done with caution and that we do so for heuristic purposes only.*

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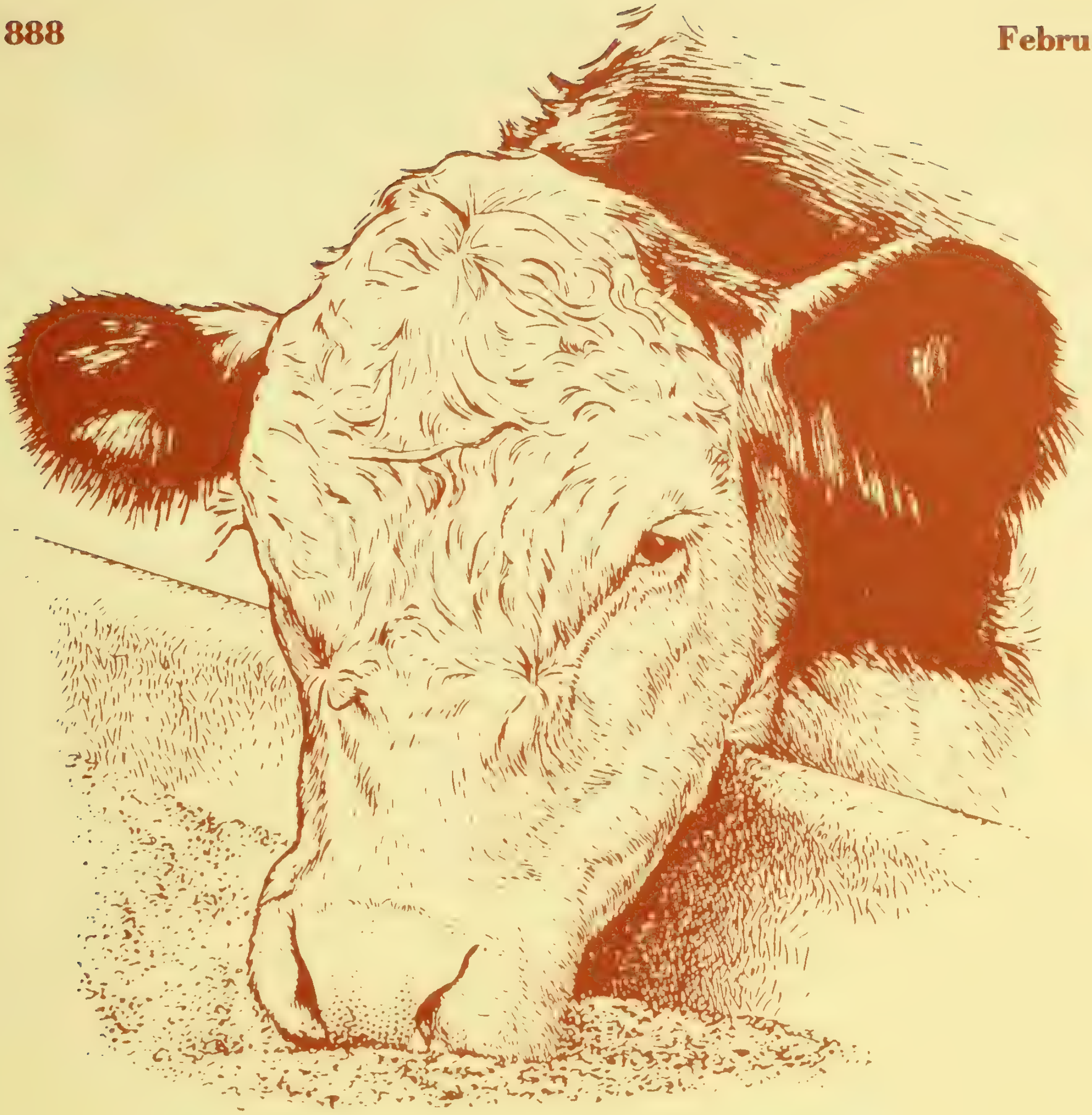

Investment, Operating Costs and Estimated Returns for 500- and 1000-Head Beef Cattle Feedlots, Mississippi, 1979

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SUMMARY AND CONCLUSIONS

Numbers of beef cattle finished in feedlots in Mississippi are low relative to feeding enterprises throughout the nation, and investment per animal unit in confinement feeding in Mississippi is high. Individuals presently find it difficult to justify to themselves (or to their lender) entrance into this type of enterprise alternative.

Some positive factors relating to such an investment decision include the availability of feeder cattle in Mississippi and the demonstrated performance of feedlot cattle on high quality corn silage. Slaughter facilities in Mississippi and adjoining states currently obtain most of their fed cattle from the High Plains but are amenable to purchasing quality fed cattle from local producers.

The abundant supply of feeder cattle in Mississippi, their feedlot performance on corn silage, the available capacity for slaughtering additional finished cattle and the likelihood of increased transportation cost for shipping cattle to the traditional feeding areas suggest the need for examination of the costs and returns that could be expected for confinement feeding operations in Mississippi.

Costs of owning and operating two different sizes (500- and 1000-head one-time capacity) of slatted-floor feedlots were estimated. Primary data were obtained from a survey of existing feedlots in Mississippi and from firms that supply materials and other inputs to cattle-feeding operations.

Initial investment was $504,000 for the 500-head lot and $894,000 for the 1000-head lot. Feed cost and length of feeding period were determined by a feedlot simulation model that incorporated a least-cost feedmix subroutine. Steers were assumed to enter the feedlot at 656 pounds and to gain an average of 2.4 lbs daily on a corn silage-based ration before being sold at 1,046 pounds after 161 days in the feedlot. Total costs per pound of gain (facility, other non-feed and feed) were $.649 for the 500-head feedlot and $.651 for the 1,000-head feedlot, assuming each was used to finish two groups of cattle per year.

Profitability (above non-feed and feed costs) for the two enterprises also was evaluated. Returns for both systems were calculated for ranges of feeder cattle buying prices and finished cattle selling prices to determine break-even price relations.

Success in a feeding operation depends most heavily on capable (or outstanding) management to (1) select a facility design complementary to management and the existing farming operation, (2) choose the proper time for entry, (3) make sound cattle purchase and marketing decisions and (4) operate the feeding phase to obtain a good rate of gain, minimize death loss and make efficient use of labor, utilities, fuel and equipment.

The potential for confinement feeding in Mississippi appears limited if viewed only in terms of the number of facilities currently operating in Mississippi and the large capital investment requirements. However, confinement finishing appears to be a viable beef alternative and a secure investment in view of its ability to integrate with existing farm operations, provide an alternative market for beef and row crops and generate a profit when bolstered by "good management"---the essential factor in successful feeding.

The abundant supply of feeder cattle in Mississippi and the in-state capacity for slaughtering finished cattle, coupled with the higher transportation costs associated with rising fuel prices, suggest that finishing cattle on a high-quality corn silage diet may be an economically feasible alternative for Mississippi producers.

Investment, Operating Costs and Estimated Returns for 00- and 1000-Head Beef Cattle Feedlots, Mississippi, 1979

onfinement feeding of cattle as alternative that might increase rns to beef producers in the theast has been of considerable rest during recent years. One or problem of potential feedlot rators is the lack of information the managerial and capital estment requirements of con- ment feeding enterprises, ential advantages from confine- t feeding and economic returns arious feeding systems.

he current production- keting-processing system con- s of shipping most Mississippi- duced weanling and feeder ves to southwestern and western pastures and feedlots, some of this beef shipped back resale and consumption after sh and slaughter. The higher sportation costs associated rising fuel prices make this m questionable if cattle can be shed profitably in Mississippi rations of high quality corn ge [1,7]. Mississippi has the slaughter-processing capacity necessary to handle additional fed beef cattle.

One problem confronting potential confinement feeding operations in the Southeast is the lack of knowledge of factors that determine the success of a feedlot operation, including detailed descriptions of managerial requirements (or sources of such information), alternative facility and equipment requirements and the necessary technical assistance. Such information, along with investment and operating cost data, is needed to provide guidance to potential beef cattle finishers and to the financial institutions that might be called on to finance investments in confinement feeding operations. Thus, specific objectives of this study were to:

1. Survey current confinement feeding operations in Mississippi and identify and describe the alternative operational techniques and types of facilities and equipment used.
2. Use an engineering approach to develop two synthesized systems for confinement feeding of beef cattle and to develop the resource requirements for
   - feed production
   - feed storage
   - feed processing and movement (ration formulation and feeding)
   - feeding containers (bunks, waterers and mineral boxes)
   - feeding floor
   - facility cover
   - cattle containment and control (equipment, health, purchase and sale)
   - manure disposal
3. Use combined non-feed and feed costs to calculate returns for both systems for different combinations of cattle buying and selling prices.

SPECIFICATION OF TWO SYNTHESIZED FEEDLOT SYSTEMS[1]

o alternative systems for hing beef cattle were hesized---a 500-head feedlot ity and a 1000-head feedlot ity. Both synthesized facilities have slatted floors since they appear to be more appropriate for confinement feeding of cattle in Mississippi. Pens within each facility are designed to accommodate 50 head, with 18.4 sq ft per animal. Other common features are pen fencing, lane fencing and type of roof structure. Both facilities have the potential to

---

The current status of confinement beef cattle feeding in Mississippi, based on results of an August 7 survey and a detailed discussion of feeding alternatives, is presented in Appendix A.

finish the same type cattle with essentially the same ration, but their operational characteristics are different.

The 500-Head Feedlot

A facility of this size, compared with the majority of feeding facilities in the United States (Gee, et al. [4]) would be considered a "farmer feedlot." The facility includes tower feed storage, a stationary mixer and a belt line feeder, combined with a deep pit manure pump-out system and a cattle working facility of low capacity. (Figure 1). The design and its operational requirements make it complementary to an existing rowcrop, cow-calf and/or backgrounding operation. Further description of the system follows:

1. Feed harvest uses conventional two-row pull-type silage cutters and silage wagons for transporting forage to the tower silo. Silage is fed from the unloader system on the silage wagon to a blower and is blown directly into the silo. This harvesting and storage system uses existing row crop tractors as its power source.
2. Feed storage consists of two 30- by 112-ft concrete tower top-unloading units with a combined capacity of about 3,000 tons. A 20- by 80-ft (20,000 bushel capacity) bottom-unloading sealed-unit silo is included for corn storage. A 14-ton bulk tank is provided for storing supplemental feed.
3. Feed processing and movement are accomplished by a stationary feeding system. Five conveyors and augers of varied lengths and types move corn to a roller mill and move silage, rolled corn and other feed components into the stationary mixer (that is equipped with electronic scales for ration blending). The conveying system deposits the feed on a 136-ft long belt feeder that can be manipulated to supply different rations to each of the ten confinement pens.
4. The feeding area has a 136-ft long concrete-bottom bunk with boarded sides, six heated waterers and ten mineral boxes. The limited bunk space (.54 ft/hd) requires that feeding be done at least twice each day. A 200-ft deep water well with pump and pressure tank is included.
5. The facility floor is constructed of concrete slats set into a prenotched beam that is supported by the walls and the center pier of an 8-ft deep manure pit. The slatted floor provides 9,248 sq ft of floor space, and 11,000 sq ft of formed concrete are provided for lanes, feed processing and working pen surfaces.
6. Facility cover is a single-span metal building with open sides. It covers 15,750 sq ft of the main facility, and a shed

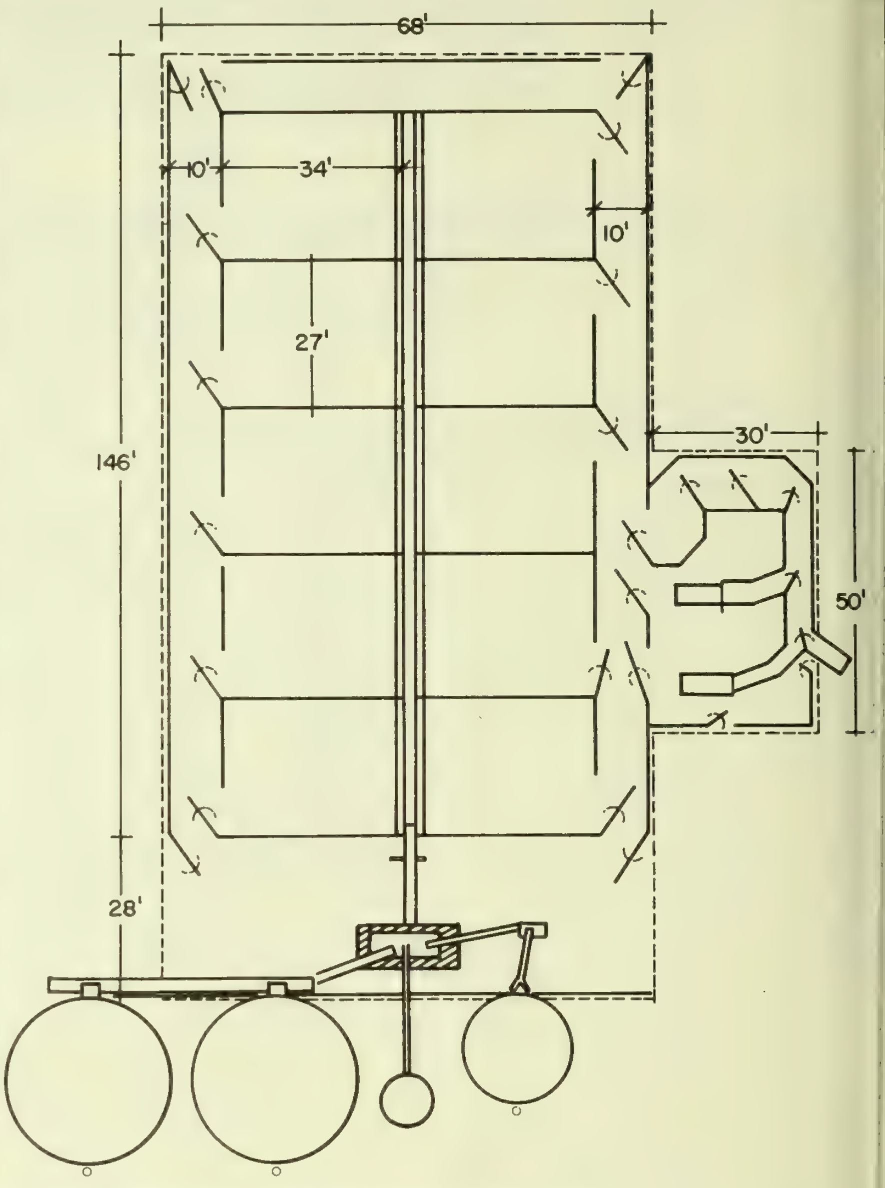

Figure 1. Design of the 500-head slatted-floor feedlot.

extension of 1,500 sq ft is included to cover the cattle working facility.

7. Cattle containment and control include 1,513 ft of pen fencing and gates, plus cattle-working equipment. Working equipment includes crowd alleys, scale, squeeze chute and loading chute.

8. Manure disposal equipment includes a power take off powered manure pump to stir and pump slurry through a 30-ft long hose to a liquid manure spreader for transporting and disposal.

This system uses existing row crop tractors as power units.

The 1000-head feedlot

A facility of this size is characteristic of the larger operations in Mississippi, and would classify as a "commercial feedlot" if compared with the majority of confinement feedlot facilities in the United States (Gee, et al [4]). A combination of bunker and tower feed storage is used, from which a feed-mixing truck collects feed ingredients from different locations, mixes the ration and delivers the ration to in-line bunks. A manure scraper system allows daily removal of manure for disposal in a two-stage lagoon system. The working facility is the same as for the 500-head lot. The design is shown in Figure 2. Even though the size of this operation dictates the need for a fulltime manager, it probably is too small to exist as an independent enterprise. Further description of the system follows:

1. The feed harvest system consists of a self-propelled three-row silage cutter with a towed hydraulically controlled side dump trailer. The silage is dumped into hydraulic dump body bobtrucks when the trailer is filled. The bobtrucks transport the silage to the silo,

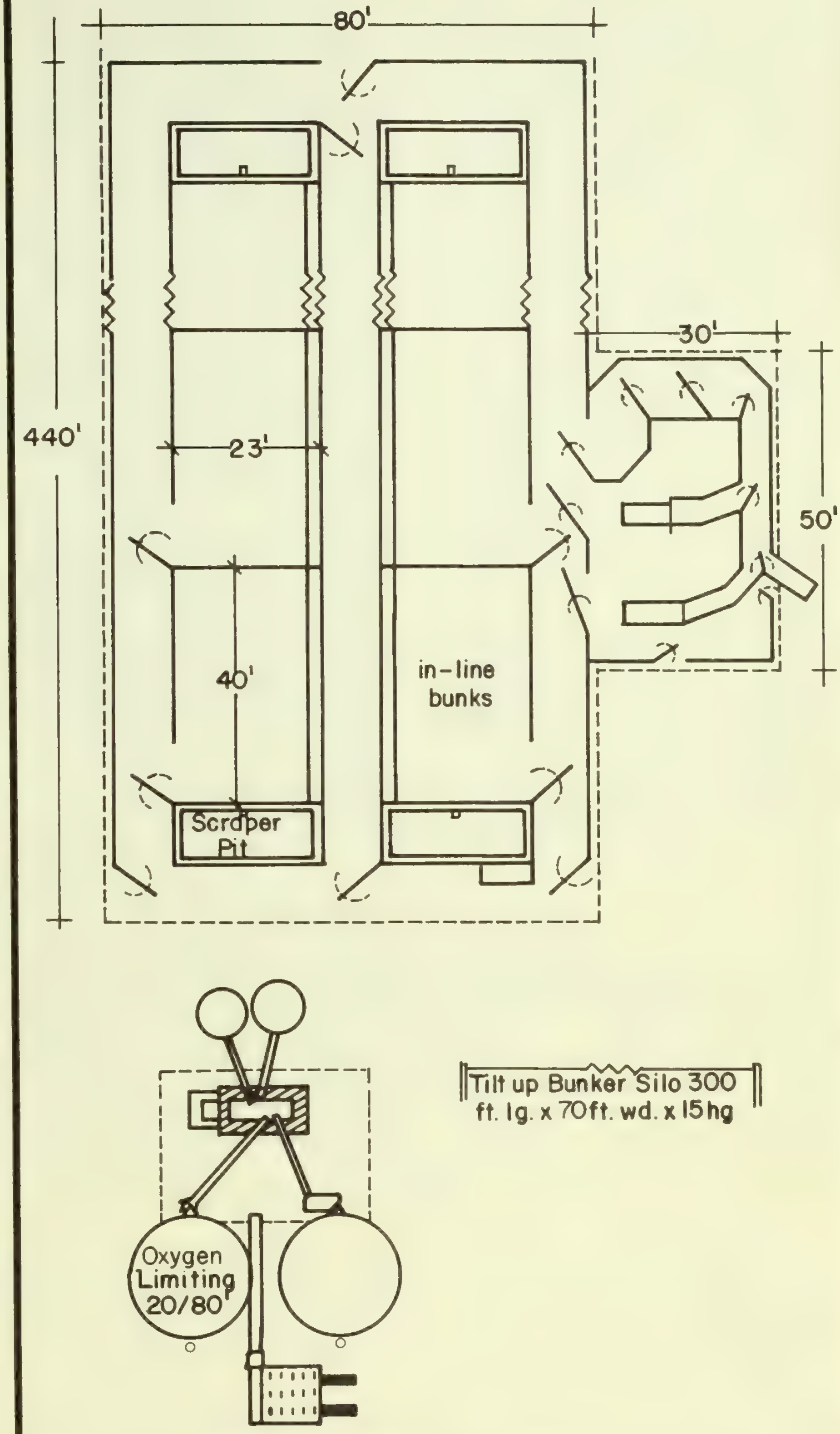

Figure 2. Design of the 1000-head slatted-floor feedlot.

where it is dumped and graded and then packed into the bunk silos by available farm tractors. Additional equipment needs are a forage blower powered by a 75-horsepower electric motor and a platform feeder or conveyor table unit to store corn grain in an upright silo.

2. Feed storage consists of a 15-ft-deep by 70-ft-wide by 300-ft-long tilt-up, bunker silo with a concrete bottom. Maintaining forage quality in this 6,000 ton storage unit requires covering by weighted-down plastic after filling. The facility also has two 20,000-bu-capacity oxygen-limiting silos with bottom unloaders for corn and two 14-ton bulk tanks with bottom augers for supplemental feeds.

3. Feed processing and movement uses a 90-horsepower tractor to operate a "cliff face" silage loader. This unit loads silage from the bunk silo into a mixer truck equipped with electronic scales. The mixer truck obtains other ration components (rolled corn augered from the roller mill and supplements augered from the bulk tanks), mixes the ration and delivers it to in-line bunks. Also included in this equipment is a flight conveyor that can be used to tie the platform feeder into the system for loading or moving silage or other feed components.

4. The feeding area has 400 ft of prefabricated feed bunks, 10 heated waterers and 10 mineral boxes. Multiple daily feedings are required due to the limited feed bunk space. A 200-ft-deep water well with pump and pressure tank is included.

5. The facility has four 3-ft-deep manure scrape pits that run the length of the facility and cover 13,320 sq ft. The 18,400 sq ft of floor over these pits is made of slats fitting into pre-notched beams. Additional facility flooring consists of 15,615 sq ft of formed concrete for lane, alley, working pen, feed processing and supply shed surfaces.

6. Facility cover consists of a single-span metal building for 35,200 sq ft of the main facility, 1,500 sq ft for the working pen and 875 sq ft for the feed processing area.

7. Cattle containment and control include pen fencing for 18,400 sq ft of slatted floor, 1,420 ft of lane- and working-pen fencing and the mechanical equipment for cattle holding, handling, weighing and loading.

8. Manure disposal is accomplished by scraping daily under the slats with drag blades hooked to cables that run the length of the manure pits. The blades pile the manure at one end of the pit over large cross augers that move it to one side of the facility. A sump pump then pushes the slurry through 200 ft of sewer pipe to a two-stage lagoon system. The aerobic and anaerobic lagoons are 6- and 9-ft deep, respectively, and have a combined surface area of 153,000 sq ft.

INITIAL AND ANNUAL INVESTMENT COSTS

Purchase prices (1979) for equipment and facility items were obtained from equipment manufacturers whose products were being used in the state at the time of the survey and from specialty contractors who have built silos, slatted-floor lots and other feedlot components in the state. The detailed list of equipment items and facility characteristics---plus estimated life, annual repair cost and amortized fixed cost---for the 500- and 1000-head facilities are presented in Tables 1 and 2, respectively. The 10% amortized fixed cost, combined with average annual repair cost, indicates the total cost per year of owning and maintaining the facility and its equipment.

ANNUAL OWNERSHIP AND OPERATING COSTS

500-Head Feedlot

Repair and ownership cost of the facility and equipment was determined to be $.215/lb of gain (Table 3). Feed cost is $103.08/hd or $.264/lb of gain.[2] Veterinarian and medical expense is $5.43/hd and $.014/lb of gain. Labor requirements total 4,242 hours, and labor cost/hd is $12.30 ($2.90/hr wage rate). Labor cost/lb of gain is $.031.

Death loss is $14.95/hd or $.038/lb of gain.[3] Cost of hauling cattle reflects a transportation charge of $2.28/hd or $.006/lb of gain and is based on recommendations of a large Mississippi cattle marketing firm.

Interest on $59,540 of purchased feed calculated at 12% for 161 days

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[2] *Totals for each of the feed components were calculated from the feeding summary in Appendix Table A-8 and the ingredient costs shown in Appendix Table A-6.*

[3] *Calculated as 3% of the purchase price of 656-lb cattle at 76¢/lb.*

Table 1. Initial investment and annual cost, 500-head slatted-floor confinement feedlot, Mississippi, 1979.

Stage	Item	Description	Price/ unit	No. of units	Amount	Expected life	Repair cost	Average annual repair cost	Amortized fixed cost 10%
			($)		($)	(yrs)	(% new cost)	($)	($)
Feed harvest:									
	1. Silage cutter	2 row pull-type	11,911.25	1	11,911.25	10	100	1,191.12	1,937.96
	2. Forage box and wagon	10 ton capacity	6,277.00	4	25,108.00	15	100	1,673.86	3,301.70
	3. Forage blower		1,961.25	1	1,961.25	10	100	196.12	319.09
Feed storage:									
	1. Upright silo	30' diameter x 112' high including blower pipe, top unloader and chute	64,800/ut	2	129,600.00	15	25	2,160.00	17,042.40
	2. Sealed unit silo	20' diameter x 80' high including blower pipe and bottom unloader (20,000 bu capacity for 15% shelled corn)	48,350/ut	1	48,350.00	15	25	805.83	6,358.02
	3. Bulk supplement tank	14 ton capacity including a 30' auger (2 h.p. elec. motor)	1,942.00	1	1,942.00	10	25	48.55	315.96
Feed processing and movement:									
	1. Level conveyor	48 ft. (2 h.p. elec. motor) (covered)	3,560.00	1	3,560.00	5	100	712.00	939.12
	2. Flight conveyor	20 ft. (2 h.p. elec. motor)	1,782.00	1	1,782.00	5	100	356.40	470.09
	3. Auger	21 ft. (2 h.p. elec. motor)	724.00	2	1,448.00	5	100	289.60	381.98
	4. Roller mill	(3 h.p. elec. motor)	3,024.00	1	3,024.00	10	50	151.20	492.00
	5. Feed mixer w/scales		19,937.50	1					
		(75 h.p. elec. motor)	3,000.00	1	22,937.50	10	50	1,146.87	3,731.93
	6. Flight conveyor	23 ft. w/swivel carriage (2 h.p. electric motor)	2,833.00	1	2,833.00	5	100	566.60	747.34
	7. Belt feeder	136' (3 h.p. electric motor)	78.21/l.f.	136	10,636.56	5	100	2,127.31	2,805.92
Feeding containers:									
	1. "H" bunks	concrete w/board sides (installed)	33.06/l.f.	136	4,496.16	20	50	112.40	528.29
	2. Waterers	Automatic & heated *Does not include installation	320.85	6	1,925.10	10	50	96.25	313.21
	3. Mineral boxes	*Does not include installation	40.00	10	400.00	10	100	40.00	65.08
	4. Water well	200 ft. w/pump and pressure tank plus electrical	2,250.00	1	2,250.00	10	50	112.50	366.07
Facility floor:									
	1. Pit	consisting of foundation, walls, floor and piers (68' wide x 136' long x 8' deep)	7.26/s.f.	9,248	67,140.48	20	25	839.25	7,889.00
	2. Slats and beams	9,248 sq. ft. (in place)	4.45/s.f.	9,248	41,153.60	20	25	514.42	4,835.54
	3. Lane surface	2 (10' wide by 136' long)	1.25/s.f.	2,720	3,400.00	20	15	25.50	399.50
		(10' wide by 90' long)	1.25/s.f.	900	1,125.00	20	15	8.43	132.18
	4. Feed processing area	27' wide by 90' long[1]	1.25/s.f.	2,430	3,037.50	20	15	22.78	356.90
	5. Cattle working area	30' wide by 50' long	1.25/s.f.	1,500	1,875.00	20	15	14.06	220.31
Facility cover:									
	1. Main roof	90' wide by 175' long w/16' eave	4.35/s.f.	15,750	68,512.50	20	25	856.40	8,050.21
	2. Working facility	30' wide by 80' long shed roof	4.35/s.f.	1,500	6,525.00	20	25	81.56	766.68
Cattle containment and control: [2]									
	1. Pen fencing	10 pens (50 head/pen)	1.34/s.f.	9,248	12,392.32	20	50	309.80	1,456.09
	2. Lane fencing		7.50/l.f.	400'	3,000.00	20	50	75.00	352.50
	3. Working pen fencing		7.50/l.f.	161'	1,207.50	20	50	30.18	141.88
	4. Working pen equipment	squeeze chute w/palpation cage	1,345.00	1	1,345.00	20	50	33.62	158.03
		scales (w/rack)	1,578.00	1	1,578.00	20	50	39.45	185.41
		crowd alley	795.00	3	2,385.00	20	50	59.62	280.23
		loading chute (20' single deck)	880.00	1	880.00	20	50	22.00	103.40
Manure disposal:									
	1. Slurry pump	PTO driven (including 30 ft. of pipe)	3,867.00	1	3,867.00	10	100	386.70	629.16
	2. Liquid manure Spreader	Tractor pull (PTO) (2,200 gal. capacity)	10,229.00	1	10,229.00	10	100	1,022.90	1,664.25
				TOTAL	$503,817.72			$16,128.28	$67,737.43

[1] Space allowance for sack feed storage.

[2] Outside pens for fresh cattle entering the lot not included.

is $3.15/hd or $.008/lb of gain. Interest on the $498,560 investment in cattle calculated at 12% for 161 days is $26.39/hd or $.067/lb of gain. Utility and fuel costs are $2.31/hd or $.006/lb of gain.

Total cost of producing 390 pounds of gain/hd in 161 days is $253.75, or $.649/lb of gain.

Table 2. Initial investment and annual cost, 1,000-head slatted-floor confinement feedlot, Mississippi, 1979.[1]

Stage	Item	Description	Price/ unit	No. of units	Amount	Expected life	Repair cost	Average annual repair cost	Amortized fixed cost 10%
			($)		($)	(yrs)	(% new cost)	($)	($)
Feed harvest:									
1.	Silage cutter	self propelled w/three row header	52,038.00	1	52,038.00	10	100	5,203.80	8,466.58
2.	Dump wagon	hydraulic side dump (tons)	6,400.00	1	6,400.00	15	100	426.67	841.60
3.	Dump truck	truck w/dump body	14,000.00	2	28,000.00	10	100	2,800.00	4,555.60
		forage gate	178.00	2	356.00	10	100	35.60	57.92
4.	Truck ramp	(custom made)	500.00	1	500.00	20	25	6.25	58.75
5.	Platform feeder	10 ft. x 14 ft. (3 h.p. electric motor)	6,895.00	1	6,895.00	15	100	459.66	906.69
6.	Forage blower		1,961.25	1	1,961.25	10	100	196.12	319.09
7.	Electric motor	portable (75 h.p.)	3,000.00	1	3,000.00	10	50	150.00	488.10
8.	Grader blade	10 ft. (heavy duty)[2]	2,465.00	1	2,465.00	15	50	82.16	324.14
Feed storage:									
1.	Bunker silo	tilt-up 15 ft. side	58.00/ft	670					
		flat surface 70 ft. wide x 300 ft. long	1.25/s.f.	21000					
		6000 ton capacity			65,110.00	20	25	813.87	7,650.42
2.	Tower silo	Oxygen limiting 20' wide 80' high (including blower pipe and bottom unloader)	54,806.00	2	109,612.00	20	50	2,740.30	12,879.41
3.	Bulk supplement tank	14 ton capacity (2 h.p. elec. motor)	1,942.00	2	3,884.00	10	25	97.10	631.92
Feed processing and movement:									
1.	Mixer truck	diesel w/twin screw axle	37,000.00	1	37,000.00	10	100	3,700.00	6,019.90
		ensile mixer w/electronic scales	19,112.50	1	19,112.50	10	100	1,911.25	3,109.60
2.	Ensiloader	cliffаce (1 ton/min)	7,500.00	1	7,500.00	10	100	750.00	1,220.25
	Tractor	(90 h.p.)	15,000.00	1	15,000.00	10	100	1,500.00	2,440.50
3.	Level conveyor	25 ft (covered) (2 h.p. elec. motor)	1,854.00	1	1,854.00	5	100	370.80	489.08
4.	Flight conveyor	23 ft w/swivel carriage (2 h.p. elec. motor)	2,833.00	1	2,833.00	5	100	566.60	747.34
5.	Roller mill	(3 h.p. elec. motor)	3,024.00	1	3,024.00	10	50	151.20	492.00
6.	Auger	23 ft. (2 h.p. elec. motor)	792.95	1	792.95	5	100	158.59	209.18
Feeding containers:									
1.	Fence line bunks	400 ft.	20.04/l.f.	400	8,016.00	20	50	200.40	941.88
2.	Waterers	Automatic & heated *Does not include installation	320.85	10	3,208.50	10	50	160.42	522.01
3.	Mineral boxes	*Does not include installation	40.00	10	400.00	10	100	40.00	65.08
4.	Water well	200 ft. w/pump and pressure tank plus electrical	2,500.00	1	2,250.00	10	50	112.50	366.07
Facility floor:									
1.	Pit	2 - 23' x 420 x 3' Deep pits foundations, walls, floors, and piers	8.16/s.f.	19,320	157,651.20	20	25	1,970.64	18,524.01
2.	Slats and beams	2 - 23' x 400 (in place)	4.45/s.f.	18,400	81,880.00	20	25	1,023.50	9,620.90
3.	Lane surface	center: 12' x 420'	1.25/s.f.	5,040	6,300.00	20	15	47.25	740.25
		side: 10' x 420'	1.25/s.f.	4,200	5,250.00	20	15	39.37	616.87
		end: 2-10' x 80'	1.25/s.f.	1,600	2,000.00	20	15	15.00	235.00
		outside: 10' x 50'[3]	1.25/s.f.	500	625.00	20	15	4.68	73.43
4.	Working pen	40' x 80'	1.25/s.f.	3,200	4,000.00	20	15	30.00	470.00
5.	Feed processing area	25' x 35'	1.25/s.f.	875	1,093.75	20	15	8.20	128.51
6.	Supply shed	10' x 20'	1.25/s.f.	200	250.00	20	15	1.87	29.37
Facility cover:									
1.	Main roof	80' wide by 440' long w/16' eave	4.35/s.f.	35,200	153,120.00	20	25	1,914.00	17,991.60
2.	Working facility	30' wide by 50' long	4.35/s.f.	1,500	6,525.00	20	25	81.56	766.69
3.	Feed processing area	25' wide by 35' long	4.35/s.f.	875	3,806.25	20	25	47.57	447.23
Cattle containment and control:[4]									
1.	Pen fencing	20 pens (50 head/pen)	1.88/s.f.	18,400	34,592.00	20	50	864.80	4,064.56
2.	Lane fencing		7.50/l.f.	980	7,350.00	20	50	183.75	863.63
3.	Working pen fencing		7.50/l.f.	161	1,207.50	20	50	30.18	141.88
4.	Working pen equipment	squeeze chute w/palpation cage	1,345.00	1	1,345.00	20	50	33.62	158.03
		scales (w/rack)	1,578.00	1	1,578.00	20	50	39.45	185.41
		crowd alley	795.00	3	2,385.00	20	50	59.62	280.23
		loading chute (20' single deck)	880.00	1	880.00	20	50	22.00	103.40
Manure disposal:									
1.	Scrapers	drive cable and blades	6,000.00	2	12,000.00	5	50	1,200.00	3,156.60
2.	Cross auger	63'	4,725.00	1	4,725.00	5	50	472.50	1,246.45
3.	Sump pump	electric motor	7,250.00	1	7,250.00	5	50	725.00	1,912.55
4.	Pipe	facility to lagoon 200'	.85/ft	200	170.00	20	25	2.12	19.97
		between ponds 15'	1.36/ft	15	20.40	20	25	.25	2.39
5.	Aeration pump		1,675.00	2	3,350.00	10	50	167.50	545.04
6.	Lagoons	1 - 9' deep 300' long 285' wide	9,991.80	1	9,991.80	25	25	99.91	1,101.10
		1 - 6' deep 300' long 225' wide	3,220.00	1	3,220.00	25	25	32.20	354.84
			13,211.80	1	13,211.80	25	25	132.11	1,455.94
				TOTAL	$893,778.10			$31,749.83	117,583.05

[1] Assume this enterprise to be intergrated with an existing operation. It is commercial due to the management and labor requirements.

[2] Requires one tractor for pushing and another for packing silage

[3] Distance varies with working pen location.

[4] Outside pens for fresh cattle entering the lot not included.

Table 3. Expected costs, 500-head one-time capacity slatted floor feedlot, two turns per year, Mississippi, 1979.

Expenses	Unit	Quantity	Price/ unit	Total amount/year	Amount/ head	Amount/ lb. gain[a]
			Dollars			
A. Facility and equipment (including interest)	each	1	83,865.71	83,865.71	83.86	.215
B. Feed costs-Total	head	1,000	--	103,084.86	103.08	.264
(1) Corn silage	tons	(2,942)	(14.80)	(43,544.14)	(43.54)	(.111)
(2) Corn	tons	(370)	(146.00)	(54,070.56)	(54.07)	(.139)
(3) Other	--	--	--	(5,470.16)	(5.47)	(.014)
C. Veterinarian and medicine	head	1,000	5.43	5,430.00	5.43*	.014
D. Labor	hours	4,242	2.90	12,311.80	12.30**	.031
E. Death loss (3% of purchase)[b]	cwt.	196.8	76	14,956.80	14.95	.038
F. Hauling[c]	head	1,000	2.28	2,280.00	2.28	.006
G. Interest on purchased feed[d]	dollars	59,540	12%/yr	3,151.58	3.15	.008
H. Interest on livestock purchase[b] [d]	dollars	498,560	12%/yr	26,389.53	26.39	.067
I. Utility and fuel	days	322	7.17	2,308.74	2.31***	.006
Total					(253.75)	.649

(Breakeven selling price = $71.92/cwt)

[a] Total amount of gain (389.99 pounds).

[b] Varies with purchase price. Figures shown are for $76/cwt.

[c] Assume cattle to be purchased at the lot.

[d] Based on number of days on feed (161 days).

* See Table A-1 of Appendix A for itemized expenses.

** See Table A-2 of Appendix A for itemized expenses.

*** See Table A-3 of Appendix A for itemized expenses.

1000-Head Feedlot

Repair and ownership cost of the facility and equipment is $.191/lb of gain (Table 4). Feed cost is the same as for the 500-head feedlot---$103.08/hd and $.264/lb of gain. Veterinarian and medicine expense is the same as for the 500-head lot---$5.43/hd and $.014/lb of gain. Cost of labor and management is $19.74/hd and $.051/lb of gain.[4]

Death loss is $14.95/hd and $.038/lb of gain. Hauling is $2.28/hd and $.006/lb of gain.

Interest on purchased feed is $3.15/hd and $.008/lb of gain. Interest on investment in livestock is $26.39/hd and $.067/lb of gain Utility and fuel costs (feed truck and silage loader costs, energy needs for storing shelled corn and daily operation of the manure scraper system and the water well) are $4.74/hd and $.012/lb of gain.

Total cost of producing 390 pounds of gain/hd in 161 days is $254.42, or $.651/lb of gain.

---

[4] *A salaried manager, two full-time men, and part-time labor (Appendix A, Table A-4).*

RETURNS ABOVE SPECIFIED COSTS FOR THE SYNTHESIZED SYSTEMS

Break-even selling prices for animals purchased at $76/cwt (Tables 3 and 4) were used to compile Tables 5 and 6 for the 500- and 1,000-head facilities, respectively. The cost components from Tables 5 and 6 were used to calculate returns above specified costs at different combinations o cattle buying and selling prices (Tables 7 and 8).

Table 4. Expected costs, 1,000 head one time capacity slatted floor feedlot, two turns per year, Mississippi, 1979.

Expenses	Unit	Quantity	Price/ unit	Total amount/year	Amount/ head	Amount/ lb. gain[a]
			dollars			
A. Facility and equipment (including interest)	each	1	149,332.88	149,332.88	74.66	.191
B. Feed cost-Total	head	2,000	--	206,169.72	103.08	.264
(1) Corn silage	tons	(5,884)	(14.80)	(87,088.28)	(43.54)	(.111)
(2) Corn	tons	(740)	(146.00)	(108,140.32)	(54.07)	(.139)
(3) Other	--	--	--	(10,941.12)	(5.47)	(.014)
C. Veterinarian and medicine	head	2,000	5.43	10,860.00	5.43*	.014
D. Labor and management	--	--	--	39,487.60	19.74**	.051
E. Death loss (3% of purchase)[b]	cwt.	393.6	76	29,913.60	14.95	.038
F. Hauling[c]	head	2,000	2.28	4,560.00	2.28	.006
G. Interest on purchased feed[d]	dollars	119,081	12%/yr	6,303.12	3.15	.008
H. Interest on livestock purchase[b][d]	dollars	997,120	12%/yr	52,779.06	26.39	.067
I. Utility and fuel	day	322	29.47	9,490.31	4.74***	.012
Total					(254.42)	.651

(Breakeven selling price = $71.98/cwt)

[a] Total amount of gain (389.99 pounds).

[b] Varies with purchase price. Figures shown are for $76/cwt.

[c] Assume cattle to be purchased at the lot.

[d] Based on number of days on feed.

* See Table A-1 of Appendix A for itemized expenses.

** See Table A-4 of Appendix A for itemized expenses.

*** See Table A-5 of Appendix A for itemized expenses.

Table 5. Assumptions used in calculating total net returns at ranges of buying and selling price for two full turns of the 500-head feedlot.

Component	Unit	Amount
Selling weight	cwt	10.46
Selling price	$/cwt	56.00 to 90.00
Buying weight	cwt	6.56
Buying price	$/cwt	60.00 to 92.00
Purchased feed cost	$/hd	59.54
Produced feed cost	$/hd	43.53
Death loss	3% of purchase cost	--[a]
Interest on purchased feed @12%	$/hd	3.15
Interest on cattle purchase	12% for 161 days (each turn)	--[a]
Utilities and fuel	$/hd	2.31
Labor (4.2 hrs @2.90/hr)	$/hd	12.30
Veterinarian and medicine	$/hd	5.43
Marketing cost	$/hd	2.28
Facility cost	$/hd	83.86

[a] Varies according to purchase price used.

Table 6. Assumptions used in calculating total net returns at ranges of buying and selling prices for two full turns of the 1,000-head feedlot.

Component	Unit	Amount
Selling weight	cwt	10.46
Selling price	$/cwt	56.00 to 90.00
Buying weight	cwt	6.56
Buying price	$/cwt	60.00 to 92.00
Purchased feed cost	$/hd	59.54
Produced feed cost	$/hd	43.53
Death loss	3% of purchase cost	--[a]
Interest on purchased feed @12%	$/hd	3.15
Interest on cattle purchase	12% for 161 days (each turn)	--[a]
Utilities and fuel	$/hd	4.74
Labor and management	$/hd	19.74
Veterinarian and medicine	$/hd	5.43
Marketing cost	$/hd	2.28
Facility cost	$/hd	74.66

[a] Varies according to purchase price used.

Table 7. Returns per head above specified costs for ranges of buying and selling prices, 500-head feedlot.

Selling price	Buying price									
	60.00	64.00	68.00	72.00	76.00	80.00	84.00	88.00	92.00	96.00
56.00	-52.83	-81.24	-109.66	-138.07	-166.48	-194.89	-223.31	-251.72	-280.13	-308.54
60.00	-10.99	-39.40	-67.82	-96.23	-124.64	-153.05	-181.47	-209.29	-238.29	-266.70
64.00	30.85	2.44	-25.98	-54.39	-82.80	-111.21	-139.63	-168.04	-196.45	-224.86
68.00	72.69	44.28	15.86	-12.55	-40.96	-69.37	-97.79	-126.20	-154.61	-183.02
72.00	114.53	86.12	57.70	29.29	.88	-27.53	-55.95	-84.36	-112.77	-141.18
76.00	156.37	127.96	99.54	71.13	42.72	14.31	-14.11	-42.52	-70.93	-99.34
80.00	198.21	169.80	141.38	112.97	84.56	56.15	27.73	-.68	-29.09	-57.50
84.00	240.05	211.64	183.22	154.81	126.40	97.99	69.57	41.16	12.75	-15.66
88.00	281.89	253.48	225.06	196.65	168.24	139.83	111.41	83.00	54.59	26.18

Table 8. Returns per head above specified costs for ranges of buying and selling prices, 1,000-head feedlot.

Selling price	Buying price 60.00	64.00	68.00	72.00	76.00	80.00	84.00	88.00	92.00	96.00
56.00	-53.50	-81.91	-110.33	-138.74	-167.15	-195.56	-223.98	-252.39	-280.80	-309.21
60.00	-11.66	-40.07	-68.49	-96.90	-125.31	-153.72	-182.14	-210.55	-238.96	-267.37
64.00	30.18	1.77	-26.65	-55.06	-83.47	-111.88	-140.30	-168.71	-197.12	-225.53
68.00	72.02	43.61	15.19	-13.22	-41.63	-70.04	-98.46	-126.87	-155.28	-183.69
72.00	113.86	85.45	57.03	28.62	.21	-28.20	-56.62	-85.03	-113.44	-141.85
76.00	155.70	127.29	98.87	70.46	42.05	13.64	-14.78	-43.19	-71.60	-100.01
80.00	197.54	169.13	140.71	112.30	83.89	55.48	27.06	-1.35	-29.76	-58.17
84.00	239.38	210.97	182.55	154.14	125.73	97.32	68.90	40.49	12.08	-16.33
88.00	281.22	252.81	224.39	195.98	167.57	139.16	110.74	82.33	53.92	25.51

APPENDIX A
Current Status of Confinement Feeding in Mississippi

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APPENDIX A

CURRENT STATUS OF CONFINEMENT FEEDING IN MISSISSIPPI

A description of the resource base and the practices used in confinement finishing of beef cattle in Mississippi was obtained through a producer survey conducted during the summer of 1978. The survey provided data on facilities in use and on current practices followed, including a general description of the feeding operation, capacity, number fed annually, cattle type, ration components, gain, origin and destination of animals, feedlot design, equipment, annual repair, labor requirements, silage crop production capabilities, purchased feed needs and descriptions of other beef cattle and row crop enterprises on the farm.

The survey located 27 facilities, 23 in Mississippi and four just across the Mississippi River (Figure A-1). Average capacity of the 12 Mississippi facilities with slatted concrete floors was 540 head. The 11 Mississippi facilities with solid concrete floors had an average capacity of 549 head.[5]

Total one-time capacity of the lots surveyed was 11,000 head and a total of 8,750 head were fed in 1978. Nine of the Mississippi facilities were visited---seven slatted-floor facilities with one-time capacity ranging from 200 to 1,050 head and two solid-floor facilities with one-time capacity of 400 and 1,000 head.

No specific type or breed of cattle dominated the preferences of confinement feeders. However, crossbred calves of good quality were most numerous, and most crossbred animals reflected some English breed characteristics (Hereford or Angus). Heifers and steers were fed in four lots, only steers were fed in five lots. Average weight of steers entering the lots was 656 pounds, and initial weights of heifers ranged from 500 to 550 pounds. Steers left the lots at an average weight of 1,077 pounds, and heifers left at 825 to 950 pounds. The majority of the feedlot operators attempted to feed two turns of cattle each year, keeping cattle in the lot an average of 176 days for each turn.

Most producers obtained cattle through auction barns and private-treaty trading. Feeder calves for the larger feedlots were acquired through order buyers. Feeding of contracted or custom-fed cattle was reported by only one operator.

The basic ration was corn silage from the feedlot operator's farm (some corn was irrigated). Some farm-grown high moisture corn was fed, and two operations used poultry waste as a feed additive. Other feed additives were purchased.

Specific information was collected on facility design and equipment. Some measurable characteristics of the slatted floor facilities were---77-head average pen capacity (average width of 32.8 ft and average length of 46.5 ft), .59 linear ft/head of bunk space and 18.05 sq ft/hd of pen space. The 400-head-capacity solid-floor feedlot had a pen capacity of 200 head, allowed 35 sq ft/hd and had 17.5 sq ft of covered area/head. The 1000-head-capacity lot had a pen capacity of 250, allowed 45 sq ft/head and had 12.8 sq ft of covered area/head. The average bunk space for both solid-floor lots was .6 linear ft/hd.

Additional survey results pertaining to the production, purchase, storage and processing of feed; facility and equipment alternatives; manure disposal; labor requirements and marketing are introduced later when needed to explain selection of the alternatives used in developing the synthesized systems.

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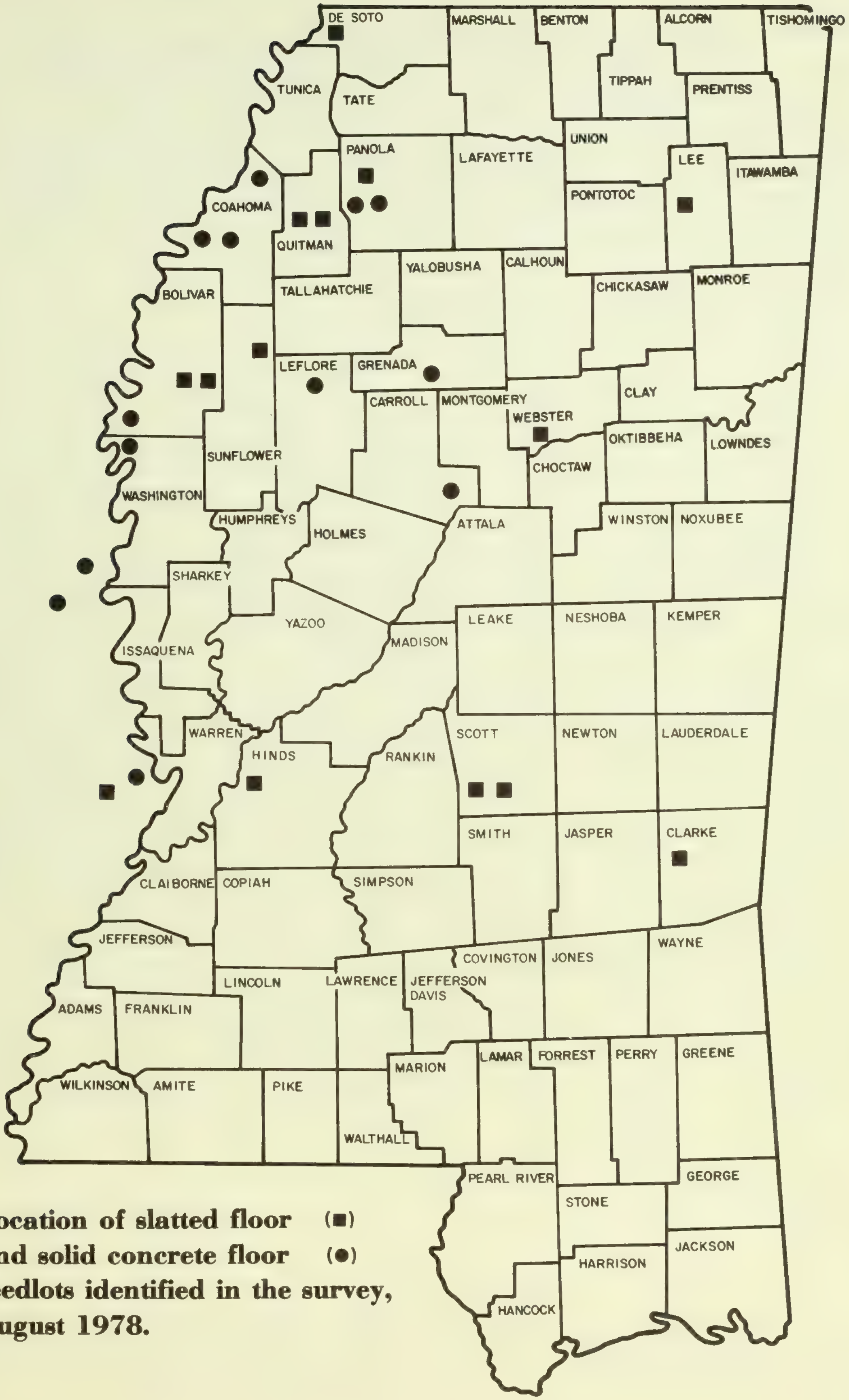
[5] *The operations with solid concrete floors were older, and only three were in operation at the time of the survey.*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ITAWAMBA
COAHOMA
PONTOTOC
QUITMAN
YALOBUSHA
CALHOUN
BOLIVAR
TALLAHATCHIE
CHICKASAW
MONROE
LEFLORE
GRENADA
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MONTGOMERY
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LOWNDES
SUNFLOWER
CHOCTAW
WASHINGTON
HUMPHREYS
HOLMES
ATTALA
WINSTON
NOXUBEE
SHARKEY
YAZOO
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NESHOBA
KEMPER
ISSAQUENA
MADISON
WARREN
HINDS
RANKIN
SCOTT
NEWTON
LAUDERDALE
SMITH
JASPER
CLARKE
CLAIBORNE
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SIMPSON
JEFFERSON
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LAWRENCE
JEFFERSON DAVIS
ADAMS
FRANKLIN
LAMAR
FORREST
PERRY
GREENE
MARION
WILKINSON
AMITE
PIKE
WALTHALL
PEARL RIVER
GEORGE
STONE
JACKSON
HARRISON
HANCOCK

Figure A-1. Location of slatted floor (■) and solid concrete floor (●) feedlots identified in the survey, August 1978.

STAGES IN A CONFINEMENT FEEDING SYSTEM

The survey of confinement feeding facilities provided insight into the diversity of the physical and managerial alternatives for carrying beef animals to finish. Eight alternative stages were defined as follow:

1. Feed production---the production of corn silage and movement of silage to the storage facility.
2. Feed storage---the different systems used to store forage, grain and purchased feed (including liquid feeds).
3. Feed processing and movement---all equipment used to move feed from storage through processing (or mixing) to the feeding point.
4. Feeding containers---bunk line (if feeding is done with a portable feed mixer) or inline troughs (if feeding is done by belt line or auger), plus containers for minerals and water.
5. Feeding floor---slatted concrete floor in feeding area and solid concrete floor for lanes, working pens and feed processing area.
6. Facility cover---metal single span or center support structure to protect the feeding floor, alleys, lanes, cattle handling facilities, bunks, open work areas and feed processing equipment from the weather.
7. Cattle handling equipment---chutes, scales and fencing of lanes and pens.
8. Manure disposal---either slurry pumped into a two-lagoon system or into tank wagons and spread on cropland.

The flow chart (Figure A-2) shows how these component stages are linked in a confinement feeding enterprise.

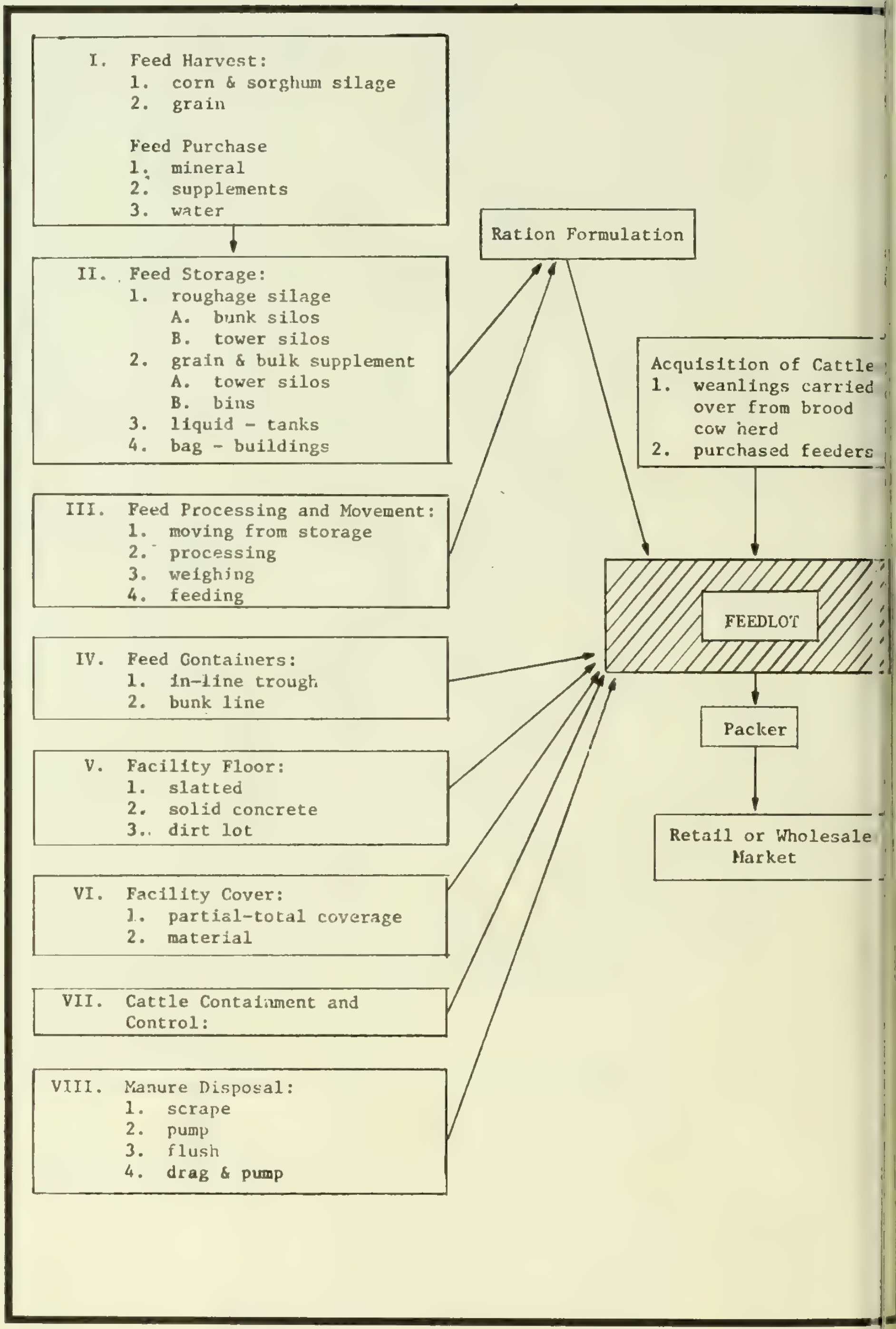
I. Feed Harvest:
1. corn & sorghum silage
2. grain
Feed Purchase
1. mineral
2. supplements
3. water
Ration Formulation
II. Feed Storage:
1. roughage silage
A. bunk silos
B. tower silos
2. grain & bulk supplement
A. tower silos
B. bins
3. liquid - tanks
4. bag - buildings
Acquisition of Cattle
1. weanlings carried over from brood cow herd
2. purchased feeders
III. Feed Processing and Movement:
1. moving from storage
2. processing
3. weighing
4. feeding
FEEDLOT
IV. Feed Containers:
1. in-line trough
2. bunk line
Packer
V. Facility Floor:
1. slatted
2. solid concrete
3. dirt lot
Retail or Wholesale Market
VI. Facility Cover:
1. partial-total coverage
2. material
VII. Cattle Containment and Control:
VIII. Manure Disposal:
1. scrape
2. pump
3. flush
4. drag & pump

Figure A-2. Flow chart representing the component sta of a cattle feeding operation.

ALTERNATIVES WITHIN STAGES

Variations in practices within each stage were identified, and appropriate practices were combined to describe (synthesize) the two sizes of feedlot operations. Pertinent information and assumptions employed in this synthesis are provided below.

Feeding

Feed production, harvest, and purchase

The most costly single item in the confinement finishing process is feed. Feed components come from on-farm production (silage, high moisture grain and animal waste products) and off-farm purchase (low moisture corn, cottonseed meal and soybean meal---all of which contain high levels of nutrients not economically obtainable by on-farm production). Corn silage was used as the base of the ration, and the cost of producing corn silage was estimated on the basis of conventional input practices. The total specified cost (including interest on operating capital) of producing an acre of corn silage in the Black Belt area[6] of Mississippi in 1979 was $158.14. Purchased feed components allowed in the least cost ration were corn grain, soybean meal, cottonseed meal, mineral mixes and feed additives. The remaining requirement is a plentiful supply of fresh, clean water---a 1,000-pound animal on full feed consumes from 7.7 to 16.5 gal of water per day, depending on the temperature [6].

Feed storage

The resource survey revealed three basic types of silo units---conventional concrete tower (continuous-pour or concrete-stave construction), oxygen-limited tower unit (sealed continuous-pour concrete or metal with sealed glass-lining construction) and bunker (pit dug out of a hill with a concrete floor or a concrete floor with tilt-up concrete side construction). Additional storage units, such as conventional metal grain bins, were used for storing supplemental feeds. Space under the confinement feeding building was used for storing sacked feed.

Type of storage differed by size of operation and by feeding method. Operations with belt and auger feeders normally had the feed storage units close to the facility to permit handling feed through the mechanized feeding system. Where feed trucks and in-line bunks were used the bunker silo was preferred because of its greater capacity and lower construction cost per storage unit.

Some factors important to the choice of type of storage are the limited capacity of most tower silos and the associated high maintenance cost for top- or bottom-unloading equipment, the high investment cost of the oxygen-limiting metal silo, the increased labor and strict attention required for ensiling in a bunker silo and the labor and expense of sealing bunker silos for protection against weather. Determining which storage choice is best for a particular operation also depends on the number of cattle to be fed per year. Storage capacity of well-packed bunker or tower silos averages 38 lbs of silage per cu ft. High moisture corn requires about 1.76 cu ft/bu and shelled corn requires 1.25 cu ft/bu [3].

One turn in a 500-head confinement facility requires 77,425 cu ft of storage space for about 1,500 tons of corn silage.[7] A 30-ft-wide by 112-ft-tall silo has 79,125 cubic feet.[8] Two tower units of this size are required for finishing two turns of cattle (1,000 head) per year in the 500-head feedlot.

Capacity calculation for a trench silo requires allowance for higher spoilage losses and uncertainty in compaction. Feeding 2,000 head of cattle in a 1,000-head capacity feedlot requires about 5,900 tons of silage (309,702 cu ft of storage space). A 300-ft-long, 70-ft-wide, and 15-ft-deep horizontal silo is sufficient if expected loss from the open end is compensated for by mounding or topping-off the facility.[9]

Required capacity of other storage units (e.g., bins and tanks) depends largely on the type of feed stored and the quantity being purchased at one time. A full year of storage often is not maintained for these components.

Feed processing and movement

Operations not set up for ration mixing usually feed straight corn silage and may add grain to the silage at ensiling time. The mechanized components include dropping silage from the silo unloader to a conveyor that deposits the product on a belt feeder to individual pens. Good judgment is needed to feed cattle adequately because these systems do not monitor the amount of feed delivered.

---

[6] *The Black Belt area was selected as an example. Costs would differ slightly in other soils areas of the state.*

[7] *Based on the least-cost feed ration calculated in the feedlot simulation program.*

[8] *The extra capacity could be considered insurance for carrying cattle further or not having a well packed silo.*

[9] *Capacity calculations for both the upright and horizontal silos are supported by data obtained in the survey.*

An alternative is to feed a mixed ration by using electronic scales in line with the conveyor units. These units monitor the amount of each feed ingredient in a ration and usually include a mineral monitor that drops a specified amount of supplemental mineral mix into the feeding ration. All components are dropped into an auger and conveyed to a beltline feeder.[10]

Another system alternative is to use the same conveyor and milling components, with mixing and weighing accomplished by depositing all feed in a stationary feed mixer equipped with scales. The mixer is powered by a large electric motor and mixes feed in large batches.

The two feed processing and movement systems just described are generally designed for use with tower storage units located near the confinement facility. Another system alternative is to use a feed mix truck to collect ration components from more than one supply point. These trucks usually are equipped with electronic scales and powerful motors to blend the feed ingredients into a homogeneous ration. The ration is dispensed from the truck into an in-line bunk on one side of the confinement pen.

Labor is always a concern in confinement feeding, and facility design and size are the major determinants of labor requirements. Competent labor seven days each week is a must in confinement feeding. The feed processing and movement system is the stage of the confinement process that requires the largest amount of attention when planning. An efficient and well-planned system will affect the management and labor demands each day an animal is in the feedlot.

Feed bunks and waterers

Two types of feeding bunks normally are used for confinement feeding---the H-type and the in-line type. Both types of construction are used in Mississippi feedlots. The H-type bunk is used with belt conveyor, auger and shuttle-type feeders. Construction of these units varies from a pre-cast unit to the poured-in-place bunk with wood sides. These bunks are placed between two confinement pens and the feeder deposits feed on either side of the bunk. In-line trough units are nearly all pre-cast. These bunks are placed along one side of a confinement pen and feed is deposited in them by a feed truck. A small (8- to 12-inch-wide by 4-inch-high) slab of concrete is placed in front of the feed bunk to prevent confined animals from backing to and excreting manure into the bunks.

Two more containers required by the confined animal are mineral boxes and waterers. A number of companies manufacture such units. Waterers constructed by the producer should be designed to minimize water waste by the confined animals.

Facility

Floor

Slatted floor facilities have pits covered with reinforced concrete beams that form a slatted surface. The poured-in-place slats (usually found in older facilities) lack the strength of pre-cast construction. They are subject to severe weather damage and broken poured-in-place slats are difficult to replace. The newer pre-cast slats come in two basic designs---individual slats that fit into a notched beam or the gang slat (a concrete unit with five slatted openings). These gang units often are used over manure drag pits because of their structural strength and easy installation. Cattle perform well on slatted floors and become rather docile when closely confined. The common space allowance is 18 sq ft per animal.

Solid concrete floors are by far the cheapest to build but often are covered only partially by a roof. The pen must be large because of the manure disposal requirements, with space allowances running 35 sq ft or more per animal. Cattle tend to be more active on a solid concrete lot than on a slatted floor.

Feeding in open dirt lots has been practiced in the past; however, the practice is not recommended for large groups of cattle. Economica gain is difficult to achieve in open lots during periods of weather stress because much of the feed is used for maintenance and not for weight gain.

Cover

Facilities with solid concrete floors had traditional pole buildings with tin roofs and provided 12 to 17 sq ft of cover per animal. These buildings require a high level of maintenance.

Facilities with slatted floors generally had a metal single span or center support building. Some were constructed from salvaged oil well material, but most were constructed by a company specializing in metal buildings.

These beltline feeders allow the feedlot operator to feed different pens of cattle different rations (for example, feeding lighter as opposed to heavier animals or heifers and steers in the same lot).

'attle containment and control quipment

Many ways of handling cattle vere demonstrated by the diversity n size, type and design of the vorking facilities found in the urvey. One major determinant of vorking pen size, design and location is the frequency of use and the olume of cattle handled each time. A plentiful supply of part-time abor and little other demand for use of the feedlot's working pen permit a lower investment in workng facilities. The less mechanized he system the more time it takes to handle each individual animal and he more stress the animal will xperience.

Some small working pens permit fficient handling of small numbers of cattle. Facilities of arger capacity may be required if an operator receives and processes arge groups of cattle for the feedlot and a winter grazing program. nvestment in additional handling quipment enables a producer to do a more efficient job of cattle sorting and grouping when additional abor is not available. Sturdily constructed lane and pen fences in he confinement facility will ensure safety and provide better control of animals.

Animal health also is an important management consideration. Proper management and early detection minimize the effort and expense of controlling many health problems. The most important considerations for herd health are minimizing stress in handling, getting cattle on feed as soon as possible, immunizing, controlling parasites and castrating and dehorning as needed. Operators who lack the experience or time for such attention will be wise to obtain professional advice. A veterinarian should be employed for regular checks of animals.

Manure disposal alternatives

Manure can be beneficial if handled properly. Manure as a slurry or solid is excellent fertilizer for row-crops and pasture,[11] and several producers reported the use of no additional nitrogen for crop production when generous applications of feedlot manure were made. Manure also can be recycled as an animal feed or fermented to form methane gas for energy production, but these processes are new and relatively untested.

Handling solid manure generally occurs when an accumulation is scraped from a solid concrete floor facility, and the labor requirement generally is higher than for most slurry systems. Handling manure slurry requires higher levels of mechanization and investment in equipment. Three of the most common methods are the deep pit pumpout system, the drag scraper with auger and pumpout and the flush system. Distributing manure over pasture or row crop acreage is becoming more restricted because of environmental protection regulations. Disposal regulations restrict the amount of allowable run-off from surface-applied feedlot waste, and inability to plow the manure under promptly because of adverse weather may cause problems for feedlot operators who use this method.[12]

Deep pit systems have large storage pits beneath a slatted floor and require only one pumping for each batch of animals confined in the lot. Pits are pumped by a high capacity pump into a slurry trailer that can distribute manure on the surface or can be equipped with knives to inject the liquid into the ground.

The manure scraper system removes manure from the shallow pits beneath a slatted floor each day by dragging manure to one end of the confinement facility with a scraper blade. The manure is then augered across and pumped out of the confinement facility and can be deposited into a lagoon system where the waste is degraded by microbiological processes. It also can be recycled as cattle feed or can be hauled away in a slurry wagon.

The flush system has a sloping shallow pit that is flushed periodically with water. The waste and water run into a lagoon system for microbiological degrading. Problems occur when manure is flushed for long distances, but these systems are common to lots of smaller capacity.

* * *

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[11] *One thousand gallons of liquid beef manure (from pit) contain about 40 pounds of nitrogen, 27 pounds of phosphorous and 34 pounds of potassium(6).*

[12] *Waste disposal regulations are available from the Bureau of Pollution Control, Oxford, Mississippi.*

Table A-1. Veterinary and medical expenses per head for the 500- and 1,000-head feedlots.[1]

Item	Unit	Quantity	Price	Amount
			($)	($)
Veterinary expense:				
Consultation & treatment	hrs.	.04	25.00[2]	1.00
Medical expense:				
Electrode 7	no.	1	.41	.41
Lep (5)	no.	1	.315	.315
Nasalgen (IBR/PI3)	no.	1	.425	.425
Benzapen	no.	1	.90	.90
Pasturella	no.	2	.075	.15
Ralgro	no.	2	.72	1.44
Pyrethrium insecticide[3]	no.	150	.003	.45
Equipment	--	--	--	.34
Total				5.43

[1] Recommended by College of Veterinary Medicine, Mississippi State University.

[2] Does not include travel expense. Veterinarian cost would vary with location and availability of practicing veterinarians.

[3] Insecticide charge should not be included for cattle fed in the winter months.

Table A-2. Labor charges, 500-head feedlot (two full turns).[1]

Type	No.	Hrs/wk	Wks/yr	Total hours	Amount/yr	Amount/head
					$	$
Full time[2]	1	70	52	3,640	10,556.00	10.56
Part time						
A. Repair	1	6	52	312	904.80	.90
B. Cattle handling	2	15	6	180	522.00	.52
C. Manure disposal	1	55	2	110	319.00	.319
Total				4,242	12,301.80	12.30

[1] All labor charged at $2.90 per hour.

[2] Labor for feeding, routine maintenance, as well as assistance to management or veterinarian for treating sick animals.

able A-3. Estimated daily utility and fuel requirements, 500-head feedlot.

Operation	Horsepower	No. of units	Average use/day	Consumption/day	$/unit	Total
			(minutes)	(kwh)[1]	(kwh)[4]	($)
op unloader	10	1	30	6.7	.06	.402
ottom unloader	10	1	30	6.7	.06	.402
uger	2	1	30	1.34	.06	.080
elt conveyor	2	3	30	4.02	.06	.241
uger	2	2	30	2.68	.06	.161
oller mill	3	1	30	2.01	.06	.121
eed mill	75	1	30	50.29	.06	3.017
elt feeder	3	1	45	3.01	.06	.181
ater well	2	1	150	6.70	.06	.402
				(gallons)	(/gal)	
lurry pump and wagon tractors	125	1	.31	1.70[3]	.90[5]	1.53
lower tractor[2]	125	1	1.6	.148	.90	.133
				(kwh)	(kwh)	
iscellaneous				8.30	.06	.50
otal						$7.17

/Conversion: (Horsepower/.7457 h.p./kwh) (Time) (Cost/kwh). Recommendations by the Department of Electrical Engineering, Mississippi State University.

/For shelled corn storage.

/Manufacturers recommendation.

/Recommendation of Mississippi Power and Light, Inc.

/MAFES Budget Recommendation.

able A-4. Labor and management charges, 1,000-head feedlot (two full turns).[1]

Type	No.	Hrs/wk	Wks/yr	Total hours	Amount/yr	Amount/head
					$	$
anagement	1	--	--	--	15,000.00	7.50
ull time labor[2]	2	70	52	7,280	21,112.00	10.56
art time						
A. Repair	1	12	52	624	1,809.60	0.90
B. Cattle handling	3	30	6	540	1,566.00	.52
Total					39,487.60	19.74

/All labor charged at $2.90 per hour.

/Labor for feeding, manure disposal operation and routine maintenance, as well as assistance to management or veterinarian for treating sick animals.

Table A-5. Estimated daily utility and fuel requirements, 1,000-head feedlot.

Operation	Horsepower	No. of units	Average/day[2]	Consumption/day	Price	Total
			(minutes)	(kwh)[3]	($/kwh)[4]	($)
Botton unloader	10	1	60	13.41	.06	.805
Unloading augers	2	1	60	2.68	.06	.161
Roller mill	3	1	60	4.02	.06	.241
Auger	2	1	60	2.68	.06	.161
Conveyor table[1]	3	1	3.3	.22	.06	.013
Blower motor[1]	75	1	3.3	5.46	.06	.328
				(gallons)[5]	($/gal)[6]	
Ensiloader tractor	90	1	30	7 gal/hr	.90	3.15
Mixer truck		1	120	6 gal/hr	.90	10.80
				(Kwh)	($/Kwh)	
Manure scraper and pump	75	2	60	201.15	.06	12.10
Aeration pump	1	2	60	2.6	.06	.16
Water wells	2	1	300	13.41	.06	.804
Miscellaneous						.75
Total						29.47

[1] For shelled corn storage.

[2] Based on length of feeding period (161 days).

[3] Conversion (horsepower/.7457 h.p./kwh) (Time) (Cost/kwh). Recommended by the Department of Electrical Engineering, Mississippi State University.

[4] Recommended by Mississippi Power and Light, Inc.

[5] Manufacturers recommendations.

[6] MAFES budget recommendations.

Table A-6. Feed ingredient prices used in the least-cost ration formulation model.

Ingredient	Cost/ton
	($)
Corn silage	14.84
Corn	146.00
Cotton seed meal (41)	222.00
Soybean meal	245.00
Dicalcium phosphate	256.00
Ground limestone	50.00
Salt	66.00

Table A-7. Least cost feed mix and summary data, by month, for a feeding period simulation.

```
                                       CONFINEMENT RATION    SEP                                              DATE = 3/8/79

                                  COST     COST              PRICE RANGE                                      ACTUAL     ACTUAL
 AMT. ADJ                          CWT      CWT     MAX    ****************                      INITIAL     AMOUNT     AMOUNT
 BATCH WT    INGREDIENT            DRY    AS FED   PRICE     LOW      HIGH    RESTRICTION          LEVEL       DRY       AS FED
****************************************************************************************************************************************

1621.626    CORN                  8.295    7.300              2.814   13.850  WEIGHT           EQU   100.000    100.000*********
 226.803    SBM                  13.764   12.250              6.587   14.880  DRY MATTER       MIN      .000     60.582*********
  10.227    GRND LIMESTONE        2.500    2.500            -21.597   38.021  C PROTEIN        MIN    13.358     13.358      8.093
  17.262    SALT                  3.300    3.300            ****************  DIG. ENERGY      MIN   158.310    158.310     95.908
5131.347    CORN SILAGE(35)       2.114     .740            ********   2.171  CALCIUM          MAX      .600       .300       .182
            CSM                  11.809   11.100    8.656                     CALCIUM          MIN      .300       .300       .182
            DICAL                12.800   12.800   -7.694                     PHOS.            MAX      .600       .320       .194
                                                                              PHOS.            MIN      .300       .320       .194
                                                                              FAT              MAX     5.000      3.444      2.086
                                                                              FIBER            MAX    25.000     14.291      8.658
                                                                              CORN             MIN      .000     41.335     23.142
                                                                              CORN SILAGE(35)MIN        .000     52.022     73.229
                                                                              CSM              MIN      .000       .000       .000
                                                                              GRND LIMESTONE   MAX     1.000       .296       .106
                                                                              DICAL            MAX     1.480       .000       .000
                                                                              SALT             EQU      .500       .500       .246
                                                                              SBM              MIN      .000      5.847      3.537

**************************************************         FEED DATA        ****************************************************


          BATCH WEIGHT(LBS)------------------------------     7007.264
          COST PER BATCH--------------------------------$      184.959
          NUMBER OF BATCHES PER DAY---------------------         2
          NUMBER OF ANIMALS(STEER )/GROUP---------------       500
          BEGINNING WT THIS PERIOD----------------------       656.000
          ENDING WT THIS PERIOD-------------------------       722.397
          TOTAL GAIN THIS PERIOD------------------------        66.397
          NUMBER OF DAYS THIS PERIOD--------------------        30
          COST PER TON OF FEED--------------------------$       52.791
          AVG FEED CONSUMPTION/HEAD(LBS)/DAY------------        28.029
          AVG FEED CONSUMPTION/GROUP(LBS)/DAY-----------     14014.529
          AVG FEED COST/HEAD/DAY------------------------$         .740
          AVG FEED COST/GROUP/DAY-----------------------$      369.919
          AVG DAILY GAIN(TARGET)(LBS)-------------------         2.600
          AVG DAILY GAIN(PROJECTED)(LBS)----------------         2.213
          AVG FEED COST/LB OF GAIN-----------------------$        .334

          FEED INGREDIENT TOTALS (LBS) FOR SEP----------------------

               CORN                                           97297.567
               SBM                                            13608.184
               GRND LIMESTONE                                   613.611
               SALT                                            1035.704
               CORN SILAGE(35)                               307880.801
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Continued--

Table A-7. Least cost feed mix and summary data, by month, for a feeding period simulation (Continued).

```
                                     CONFINEMENT RATION    OCT                                                   DATE = 3/8/79

                                     COST      COST               PRICE RANGE                                            ACTUAL     ACTUAL
 AMT. ADJ                            CWT       CWT      MAX     ****************                          INITIAL    AMOUNT     AMOUNT
 BATCH WT    INGREDIENT              DRY       AS FED   PRICE     LOW     HIGH    RESTRICTION              LEVEL      DRY        AS FED
*****************************************************************************************************************************************

  370.646    CORN                    8.295     7.300              3.604  13.342   WEIGHT           EQU    100.000    100.000*********
   19.885    SBM                    13.764    12.250              6.878  14.246   DRY MATTER       MIN       .000     44.326*********
    1.115    DICAL                  12.800    12.800             -7.694  79.132   C PROTEIN        MIN     12.030     12.030      5.332
    1.216    GRND LIMESTONE          2.500     2.500            -21.518  38.021   DIG. ENERGY      MIN    146.150    146.150     64.783
   10.218    SALT                    3.300     3.300           ****************   CALCIUM          MAX       .600 -     .300       .133
 4820.257    CORN SILAGE(35)         2.114      .740           ********   1.939   CALCIUM          MIN       .300       .300       .133
             CSM                    11.809    11.100    9.233                     PHOS.            MAX       .600       .300       .133
                                                                                  PHOS.            MIN       .300       .300       .133
                                                                                  FAT              MAX      5.000      3.189      1.413
                                                                                  FIBER            MAX     25.000     20.526      9.099
                                                                                  CORN             MIN       .000     15.961      7.096
                                                                                  CORN SILAGE(35)MIN         .000     82.559     92.283
                                                                                  CSM              MIN       .000       .000       .000
                                                                                  GRND LIMESTONE   MAX      1.000       .059       .023
                                                                                  DICAL            MAX      1.480       .055       .021
                                                                                  SALT             EQU       .500       .500       .196
                                                                                  SBM              MIN       .000       .866       .381

****************************************************          FEED DATA        ****************************************************


             BATCH WEIGHT(LBS)-------------------------------       5223.337
             COST PER BATCH---------------------------------$         65.673
             NUMBER OF BATCHES PER DAY----------------------           4
             NUMBER OF ANIMALS(STEER )/GROUP----------------         500
             BEGINNING WT THIS PERIOD-----------------------         722.397
             ENDING WT THIS PERIOD--------------------------         802.868
             TOTAL GAIN THIS PERIOD-------------------------          80.472
             NUMBER OF DAYS THIS PERIOD---------------------          31
             COST PER TON OF FEED---------------------------$         25.146
             AVG FEED CONSUMPTION/HEAD(LBS)/DAY-------------          41.787
             AVG FEED CONSUMPTION/GROUP(LBS)/DAY------------      20893.347
             AVG FEED COST/HEAD/DAY-------------------------$           .525
             AVG FEED COST/GROUP/DAY------------------------$        262.693
             AVG DAILY GAIN(TARGET)(LBS)--------------------           2.600
             AVG DAILY GAIN(PROJECTED)(LBS)-----------------           2.596
             AVG FEED COST/LB OF GAIN-----------------------$           .202

             FEED INGREDIENT TOTALS (LBS) FOR OCT------------------


                  CORN                                             45960.104
                  SBM                                               2465.783
                  DICAL                                              138.308
                  GRND LIMESTONE                                     150.746
                  SALT                                              1266.973
                  CORN SILAGE(35)                                 597711.836
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Continued--

Table A-7. Least cost feed mix and summary data, by month, for a feeding period simulation (Continued).

```
                                           CONFINEMENT RATION    NOV                                                       DATE = 3/8/79

                                          COST     COST               PRICE RANGE                                            ACTUAL      ACTUAL
 AMT. ADJ                                 CWT      CWT      MAX    ****************                          INITIAL    AMOUNT      AMOUNT
 BATCH WT    INGREDIENT                   DRY      AS FED   PRICE     LOW     HIGH     RESTRICTION            LEVEL     DRY         AS FED
****************************************************************************************************************************************

  547.566    CORN                         8.295    7.300               3.604  13.342   WEIGHT           EQU   100.000    100.000*********
   22.784    SBM                         13.764   12.250               6.878  14.246   DRY MATTER       MIN      .000     47.532*********
     .851    DICAL                       12.800   12.800              -7.694  79.132   C PROTEIN        MIN    11.927     11.927     5.669
    2.515    GRND LIMESTONE               2.500    2.500             -21.518  38.021   DIG. ENERGY      MIN   148.611    148.611    70.637
   10.999    SALT                         3.300    3.300             ****************  CALCIUM          MAX      .600       .300      .143
 4809.418    CORN SILAGE(35)              2.114     .740             ********   1.939  CALCIUM          MIN      .300       .300      .143
             CSM                         11.809   11.100    9.233                      PHOS.            MAX      .600       .300      .143
                                                                                       PHOS.            MIN      .300       .300      .143
                                                                                       FAT              MAX     5.000      3.270     1.554
                                                                                       FIBER            MAX    25.000     19.248     9.149
                                                                                       CORN             MIN      .000     21.905    10.151
                                                                                       CORN SILAGE(35)MIN        .000     76.520    89.160
                                                                                       CSM              MIN      .000       .000      .000
                                                                                       GRND LIMESTONE   MAX     1.000       .114      .047
                                                                                       DICAL            MAX     1.480       .039      .016
                                                                                       SALT             EQU      .500       .500      .204
                                                                                       SBM              MIN      .000       .922      .422

****************************************************           FEED DATA         **************************************************


             BATCH WEIGHT(LBS)--------------------------------      5394.134
             COST PER BATCH----------------------------------$        78.888
             NUMBER OF BATCHES PER DAY-----------------------          4
             NUMBER OF ANIMALS(STEER )/GROUP-----------------        500
             BEGINNING WT THIS PERIOD------------------------        802.868
             ENDING WT THIS PERIOD---------------------------        875.150
             TOTAL GAIN THIS PERIOD--------------------------         72.281
             NUMBER OF DAYS THIS PERIOD----------------------         30
             COST PER TON OF FEED----------------------------$        29.250
             AVG FEED CONSUMPTION/HEAD(LBS)/DAY--------------         43.153
             AVG FEED CONSUMPTION/GROUP(LBS)/DAY-------------      21576.537
             AVG FEED COST/HEAD/DAY--------------------------$          .631
             AVG FEED COST/GROUP/DAY-------------------------$       315.551
             AVG DAILY GAIN(TARGET)(LBS)---------------------          2.600
             AVG DAILY GAIN(PROJECTED)(LBS)------------------          2.409
             AVG FEED COST/LB OF GAIN-------------------------$          .262

             FEED INGREDIENT TOTALS (LBS) FOR NOV-------------------

                  CORN                                             65707.955
                  SBM                                               2734.107
                  DICAL                                              102.109
                  GRND LIMESTONE                                     301.848
                  SALT                                              1319.879
                  CORN SILAGE(35)                                 577130.195
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Continued--

Table A-7. Least cost feed mix and summary data, by month, for a feeding period simulation (Continued).

```
                                   CONFINEMENT RATION    DEC                                                       DATE = 3/8/79

                                       COST     COST               PRICE RANGE                                       ACTUAL     ACTUAL
 AMT. ADJ                              CWT      CWT      MAX    ****************                         INITIAL     AMOUNT     AMOUNT
 BATCH WT    INGREDIENT                DRY      AS FED   PRICE    LOW     HIGH    RESTRICTION             LEVEL      DRY        AS FED
************************************************************************************************************************************

  568.958    CORN                      8.295     7.300             3.604  13.342  WEIGHT            EQU   100.000    100.000*********
    5.425    SBM                      13.764    12.250             6.878  14.246  DRY MATTER        MIN      .000     47.125*********
    1.203    DICAL                    12.800    12.800            -7.694  79.132  C PROTEIN         MIN    11.662     11.662      5.496
    2.390    GRND LIMESTONE            2.500     2.500           -21.518  38.021  DIG. ENERGY       MIN   148.334    148.334     69.902
   11.454    SALT                      3.300     3.300          ****************  CALCIUM           MAX      .600       .300       .141
 5057.843    CORN SILAGE(35)           2.114      .740          ********   1.939  CALCIUM           MIN      .300       .300       .141
             CSM                      11.809    11.100   9.233                    PHOS.             MAX      .600       .300       .141
                                                                                  PHOS.             MIN      .300       .300       .141
                                                                                  FAT               MAX     5.000      3.282      1.547
                                                                                  FIBER             MAX    25.000     19.373      9.130
                                                                                  CORN              MIN      .000     21.856     10.075
                                                                                  CORN SILAGE(35)MIN         .000     77.276     89.563
                                                                                  CSM               MIN      .000       .000       .000
                                                                                  GRND LIMESTONE    MAX     1.000       .104       .042
                                                                                  DICAL             MAX     1.480       .052       .021
                                                                                  SALT              EQU      .500       .500       .203
                                                                                  SBM               MIN      .000       .211       .096

************************************************************  FEED DATA  ***************************************************


                BATCH WEIGHT(LBS)----------------------------     5647.273
                COST PER BATCH-------------------------------$      80.218
                NUMBER OF BATCHES PER DAY--------------------        4
                NUMBER OF ANIMALS(STEER )/GROUP--------------      500
                BEGINNING WT THIS PERIOD---------------------      875.150
                ENDING WT THIS PERIOD------------------------      947.793
                TOTAL GAIN THIS PERIOD-----------------------       72.643
                NUMBER OF DAYS THIS PERIOD-------------------       31
                COST PER TON OF FEED-------------------------$      28.410
                AVG FEED CONSUMPTION/HEAD(LBS)/DAY-----------       45.178
                AVG FEED CONSUMPTION/GROUP(LBS)/DAY----------    22589.091
                AVG FEED COST/HEAD/DAY-----------------------$        .642
                AVG FEED COST/GROUP/DAY----------------------$     320.873
                AVG DAILY GAIN(TARGET)(LBS)------------------        2.600
                AVG DAILY GAIN(PROJECTED)(LBS)---------------        2.343
                AVG FEED COST/LB OF GAIN----------------------$       .274

                FEED INGREDIENT TOTALS (LBS) FOR DEC------------------

                     CORN                                        70550.771
                     SBM                                           672.757
                     DICAL                                         149.110
                     GRND LIMESTONE                                296.329
                     SALT                                         1420.298
                     CORN SILAGE(35)                            627172.547
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Continued--

Table A-7. **Least cost feed mix and summary data, by month, for a feeding period simulation (Continued).**

```
                                          CONFINEMENT RATION    JAN                                                       DATE = 3/8/79

                                      COST     COST               PRICE RANGE                                            ACTUAL    ACTUAL
  AMT. ADJ                             CWT      CWT     MAX    ****************                             INITIAL     AMOUNT    AMOUNT
 BATCH WT    INGREDIENT                DRY     AS FED   PRICE    LOW       HIGH    RESTRICTION                LEVEL      DRY       AS FED
*******************************************************************************************************************************************

  581.103    CORN                    8.295    7.300              1.881  13.342    WEIGHT            EQU    100.000   100.000*********
    1.371    DICAL                  12.800   12.800             -6.398 175.547    DRY MATTER        MIN       .000    46.802*********
    2.333    GRND LIMESTONE          2.500    2.500            -18.674  35.826    C PROTEIN         MIN     11.435    11.591     5.425
   11.913    SALT                    3.300    3.300           ****************    DIG. ENERGY       MIN    148.097   148.097    69.312
 5301.492    CORN SILAGE(35)         2.114     .740           ********   2.440    CALCIUM           MAX       .600      .300      .140
             CSM                    11.809   11.100    4.207                      CALCIUM           MIN       .300      .300      .140
             SBM                    13.764   12.250    6.878                      PHOS.             MAX       .600      .300      .140
                                                                                  PHOS.             MIN       .300      .300      .140
                                                                                  FAT               MAX      5.000     3.281     1.535
                                                                                  FIBER             MAX     25.000    19.491     9.122
                                                                                  CORN              MIN       .000    21.464     9.852
                                                                                  CORN SILAGE(35)MIN          .000    77.881    89.683
                                                                                  CSM               MIN       .000      .000      .000
                                                                                  GRND LIMESTONE    MAX      1.000      .098      .040
                                                                                  DICAL             MAX      1.480      .058      .023
                                                                                  SALT              EQU       .500      .500      .202
                                                                                  SBM               MIN       .000      .000      .000

*****************************************************          FEED DATA       ****************************************************


             BATCH WEIGHT(LBS)---------------------------     5898.211
             COST PER BATCH-------------------------------$     82.278
             NUMBER OF BATCHES PER DAY--------------------       4
             NUMBER OF ANIMALS(STEER )/GROUP--------------     500
             BEGINNING WT THIS PERIOD---------------------     947.793
             ENDING WT THIS PERIOD------------------------    1026.679
             TOTAL GAIN THIS PERIOD-----------------------      78.886
             NUMBER OF DAYS THIS PERIOD-------------------      31
             COST PER TON OF FEED-------------------------$     27.899
             AVG FEED CONSUMPTION/HEAD(LBS)/DAY-----------      47.186
             AVG FEED CONSUMPTION/GROUP(LBS)/DAY----------   23592.843
             AVG FEED COST/HEAD/DAY-----------------------$       .658
             AVG FEED COST/GROUP/DAY----------------------$    329.114
             AVG DAILY GAIN(TARGET)(LBS)------------------       2.600
             AVG DAILY GAIN(PROJECTED)(LBS)---------------       2.545
             AVG FEED COST/LB OF GAIN----------------------$      .259

             FEED INGREDIENT TOTALS (LBS) FOR JAN-----------------

                  CORN                                       72056.767
                  DICAL                                        169.964
                  GRND LIMESTONE                               289.235
                  SALT                                        1477.155
                  CORN SILAGE(35)                           657385.008
```

Continued-

Table A-7. Least cost feed mix and summary data, by month, for a feeding period simulation (Continued).

```
                                         CONFINEMENT RATION    FEB                                                      DATE = 3/8/79

                                        COST      COST               PRICE RANGE                                        ACTUAL      ACTUAL
  AMT. ADJ                               CWT       CWT     MAX     ****************                         INITIAL     AMOUNT      AMOUNT
 BATCH WT   INGREDIENT                   DRY     AS FED   PRICE     LOW      HIGH    RESTRICTION              LEVEL       DRY        AS FED
*****************************************************************************************************************************************

  586.660   CORN                        8.295     7.300            1.881   13.342   WEIGHT            EQU   100.000   100.000*********
    1.428   DICAL                      12.800    12.800           -6.398  175.547   DRY MATTER        MIN      .000    46.615*********
    2.316   GRND LIMESTONE              2.500     2.500          -18.674   35.826   C PROTEIN         MIN    11.298    11.599      5.407
   12.226   SALT                        3.300     3.300          *****************  DIG. ENERGY       MIN   147.954   147.954     68.969
 5465.352   CORN SILAGE(35)             2.114      .740          ********    2.440  CALCIUM           MAX      .600      .300       .140
            CSM                        11.809    11.100   4.207                     CALCIUM           MIN      .300      .300       .140
            SBM                        13.764    12.250   6.878                     PHOS.             MAX      .600      .300       .140
                                                                                    PHOS.             MIN      .300      .300       .140
                                                                                    FAT               MAX     5.000     3.276      1.527
                                                                                    FIBER             MAX    25.000    19.566      9.121
                                                                                    CORN              MIN      .000    21.114      9.868
                                                                                    CORN SILAGE(35)   MIN      .000    78.233     90.169
                                                                                    CSM               MIN      .000      .000       .000
                                                                                    GRND LIMESTONE    MAX     1.000      .095       .038
                                                                                    DICAL             MAX     1.480      .058       .024
                                                                                    SALT              EQU      .500      .500       .201
                                                                                    SRM               MIN      .000      .000       .000

***************************************************          FEED DATA          *************************************************

            BATCH WEIGHT(LBS)-----------------------------    6067.982
            COST PER BATCH-------------------------------$     83.914
            NUMBER OF BATCHES PER DAY---------------------        4
            NUMBER OF ANIMALS(STEER )/GROUP---------------      500
            BEGINNING WT THIS PERIOD----------------------   1026.679
            ENDING WT THIS PERIOD-------------------------   1045.994
            TOTAL GAIN THIS PERIOD------------------------     19.315
            NUMBER OF DAYS THIS PERIOD--------------------        8
            COST PER TON OF FEED-------------------------$     27.658
            AVG FEED CONSUMPTION/HEAD(LBS)/DAY------------     48.544
            AVG FEED CONSUMPTION/GROUP(LBS)/DAY-----------  24271.927
            AVG FEED COST/HEAD/DAY-----------------------$       .671
            AVG FEED COST/GROUP/DAY----------------------$    335.656
            AVG DAILY GAIN(TARGET)(LBS)-------------------      2.600
            AVG DAILY GAIN(PROJECTED)(LBS)----------------      2.414
            AVG FEED COST/LB OF GAIN----------------------$      .278

            FEED INGREDIENT TOTALS (LBS) FOR FEB------------------

                 CORN                                         18773.122
                 DICAL                                           45.696
                 GRND LIMESTONE                                  74.113
                 SALT                                           391.217
                 CORN SILAGE(35)                             174891.260

                              LAST DIET --- END PROGRAM
```

SOURCE [5]

Table A-8. Feeding period simulation summary, 500-head feedlot.

```
**************************************************  FEEDING SUMMARY

            NUMBER OF ANIMALS ON FEED------------------       500.000
            ANIMAL TYPE--------------------------------       STEER
            INITIAL WEIGHT (LBS)-----------------------       656.000
            DAYS ON FEED-------------------------------       161
            FINISH WEIGHT------------------------------      1045.994
            BEGINNING MONTH----------------------------       SEP
            ENDING MONTH-------------------------------       FEB
            ENVIRONMENTAL STRESS-----------------------       SLIGHT
            AVG DAILY GAIN(TARGET)(LBS)----------------         2.600
            AVG DAILY GAIN(PROJECTED)(LBS)-------------         2.422
            TOTAL AMOUNT OF GAIN-----------------------       389.994
            AVG FEED COST PER LB GAIN------------------          .266
            FEED INGREDIENT TOTALS (LBS) FOR PERIOD-----------

                 CORN                                      370346.285
                 SBM                                        19480.831
                 GRND LIMESTONE                              1725.883
                 SALT                                        6911.225
                 CORN SILAGE(35)                          2942171.625
                 DICAL                                        605.187
```

Table A-9. Feeding period simulation summary, 1,000-head feedlot.

```
**************************************************  FEEDING SUMMARY

            NUMBER OF ANIMALS ON FEED------------------      1000.000
            ANIMAL TYPE--------------------------------       STEER
            INITIAL WEIGHT (LBS)-----------------------       656.000
            DAYS ON FEED-------------------------------       161
            FINISH WEIGHT------------------------------      1045.994
            BEGINNING MONTH----------------------------       SEP
            ENDING MONTH-------------------------------       FEB
            ENVIRONMENTAL STRESS-----------------------       SLIGHT
            AVG DAILY GAIN(TARGET)(LBS)----------------         2.600
            AVG DAILY GAIN(PROJECTED)(LBS)-------------         2.422
            TOTAL AMOUNT OF GAIN-----------------------       389.994
            AVG FEED COST PER LB GAIN------------------          .266
            FEED INGREDIENT TOTALS (LBS) FOR PERIOD-----------

                 CORN                                      740692.570
                 SBM                                        38961.661
                 GRND LIMESTONE                              3451.765
                 SALT                                       13822.450
                 CORN SILAGE(35)                          5884343.250
                 DICAL                                       1210.375
```

APPENDIX B

EQUIPMENT COMPANIES THAT CONTRIBUTED INFORMATION TO THIS STUDY*

Badger Northland, Inc., Kaukawna, Wisconsin
Bridgeforth Equipment Company, Perkins, Mississippi
Bowman Hydro-Vat, Inc., Fremont, Nebraska
Butler Manufacturing Company, Green City, Kansas
The Calument Company, Algoma, Wisconsin
Clark Equipment Company, Jackson, Mississippi
Clay Equipment Corporation, Cedar Falls, Iowa
Conrad-American, Eckford Dairy Supply, Starkville, Mississippi
H. C. Davis Sons Manufacturing Company, Bonner Springs, Kansas
Farm Hand Equipment Company, Hopkins, Minnesota
Granger, W. W. Granger Company, Jackson, Mississippi
Gehl Company, West Bend, Wisconsin
Gulf States Manufacturing, Starkville, Mississippi
Harvestore Products , Dixie Harvestore, McComb, Mississippi
Hesston Corporation, Hesston, Kansas
International Harvester, Triangle Equipment Company, Columbus, Mississippi
International Truck, Jackson, Mississippi
John Deere, Starkville District, Starkville, Mississippi
Kelly Ryan Equipment, Blair Manufacturing Company, Blair, Nebraska
Koehring, Fox Harvesting, Appleton, Wisconsin
Memphis Concrete Silo, Memphis, Tennessee
Mississippi Pump and Equipme Company, Jackson, Mississip
Mississippi Serum Distributo Jackson, Mississippi
Sperry-New Holland, Ne Holland, Pennsylvania
Piedmont Silo Company, In Covington, Georgia
People Green Constructio Jackson, Mississippi
Randolph Slats, Randolp Wisconsin
Rebel Trucks, Jackson, Mississip
Ritchie Industries, Inc., Conra Iowa
St. John Welding and Manufa turing, Inc., St. John, Kansas
W-W Manufacturing Compa Dodge City, Kansas
Weiser Concrete Products, Maid Rock, Wisconsin

**Additional information can be obtained from Department of Agricultural Economics, Mississippi State University.*

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[4] Gee, Kerry C., Roy N. Van Arsdall and Ronald A. Gustafson, "U.S. Fed-Beef Production Costs, 1976-77, and Industry Structure, U.S. Department of Agriculture, *Agricultural Economics Report No. 424*, June 1979.

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1980 Mississippi Hybrid Corn Performance Trials

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Delta States Area, AR, SEA, USDA

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in Cooperation with

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1878

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The following cooperated with the authors in conducting these tests:

B. L. Arnold, superintendent, North Mississippi Branch Station

H. D. Palmertree, superintendent, Pontotoc Ridge-Flatwoods Branch Station

Normie Buehring, agronomist, Northeast Mississippi Branch Station

Theodore C. Miller, agronomist, Delta Branch Station

Robert E. Coats, superintendent, Black Belt Branch Station

J. W. McMillan, agronomist, Coastal Plains Branch Station

Ned C. Edwards, agronomist, Brown Loam Branch Station

Carl Hovermale, agronomist, South Mississippi Branch Station

The test reported in Wilkinson County was on a private farm through the cooperation of T. O. Whitaker, RFD 4, Woodville, and John Dale, county agent.

1980
Mississippi Hybrid Corn Performance Trials

Trials are conducted annually in Mississippi to provide farmers, seedsmen, county agents and other interested persons with information on the performance of commercially available corn hybrids. Results of the trials are provided for use by corn producers in selecting hybrids suited to their area. New hybrids may be compared with familiar hybrids.

Corn hybrids respond differently to variations in environment, and a given hybrid is not always the best under all conditions. Therefore, it is suggested that corn producers grow two or more good hybrids each year. This practice also reduces the chances for spread of a disease or insect infestation through the total corn acreage.

The yield of harvestable, good-quality grain (or silage) determines the desirability of corn hybrids. However, attributes other than yield may be extremely important in some instances. For example, resistance to a particular disease should be the prime consideration in areas where the disease occurs. That is, hybrids selected should be from those known to have resistance to diseases found in a geographic area.

All producers and/or distributors of seed corn are eligible to enter hybrids in these tests. Hybrids can be entered for testing in Area I (northern Mississippi), Area II (southern Mississippi), or both. The producers designate the hybrids they want entered in each area. Hybrids must be submitted for entry to the Mississippi Agricultural and Forestry Experiment Station by Feb. 15. A nominal fee is charged for each hybrid tested in each area to help defray costs for the test.

Three or more tests were located in each area. Trials were conducted at 10 locations in 1980 (Table 1).

The best guide to the desirability of a hybrid is its performance over a period of years at a number of locations. Therefore, three-year summaries are reported for each area.

Table 1. Location, number of entries and dates of planting and harvest of hybrid corn performance trials in Mississippi, 1980.

County	Location	No. of entries	Planting date	Harvest date
Marshall	Holly Springs	49	April 23	-----
Pontotoc	Pontotoc	49	April 22	-----
Lee	Verona	49	April 24	Sept. 11
Noxubee	Brooksville	49	May 2	-----
Oktibbeha	Mississippi State	49	April 11	Sept. 16
Washington	Stoneville	49	April 7	Sept. 8
Newton	Newton	55	April 21	Sept. 4
Hinds	Raymond	55	May 12	-----
Wilkinson	Woodville	55	April 30	-----
Pearl River	Poplarville	55	April 16	Sept. 3

MATERIALS AND METHODS

Hybrids were tested in a randomized complete block experimental design with three replications at two population levels. Each plot consisted of two rows, 38 or 40 inches apart and 200 inches long. All tests were overplanted and later thinned to either 16,000 or 22,000 plants per acre, stand permitting. Fertilizer was applied by each cooperator as he thought necessary, and weeds were controlled by cultivation and herbicides.

All tests were harvested with a mechanical picker-sheller. Grain harvested from each plot was weighed, and moisture content was determined. All weights were converted to bushels per acre at 15.5% moisture.

Test Results-Area 1

Dry weather prevailed during the corn growing season in 1980. The tests at Holly Springs, Pontotoc and Brooksville were not harvested because of low yields and/or high variability within the test area. Also, data for the test at 16,000 plants per acre at Mississippi State were discarded because of high variability within the test.

Yields of the 49 hybrids grown at 16,000 plants per acre at two locations (Stoneville and Verona) ranged from 56 to 98 bu/acre and averaged 79 bu (Table 2). Average yield of the same hybrids grown at 22,000 plants per acre at three locations (Stoneville, Mississippi State and Verona) was 74 bu, with a range of 51 to 96 bu (Table 3).Yields at the two plant populations varied by location. Average yields at 16,000 and 22,000 plants per acre, respectively, were 85 and 102 bu/acre at Verona, 74 and 69 bu at Stoneville.

The only root lodging in the harvested tests was by two of the hybrids grown at 16,000 plants per acre. Stalk lodging at each plant population averaged 6%, with a range of 1 to 17% at 16,000 plants per acre and 1 to 15% at 22,000 plants per acre. Ear height averaged 3.9 ft in the tests at 16,000 plants per acre, 3.7 ft in the tests at 22,000 plants per acre. Time from planting to 50% silking in the test at 22,000 plants per acre at Mississippi State ranged from 73 to 85 days.

Moisture content of grain harvested at the three locations ranged from 12.8 to 17.4%. Stands at the three test locations ranged from 89 to 102%.

The three-year average yields of the 16 hybrids that have been tested for three years at 16,000 plants per acre ranged from 65 to 88 bu/acre (Table 4). The three-year average yields of the same hybrids at 22,000 plants per acre ranged from 67 to 82 bu/acre (Table 5).

Test Results-Area 2

Plantings were delayed by one month or more because of excessive soil moisture. Stands needed for conducting the tests were not obtained at Woodville or Raymond and these tests were abandoned. The Poplarville test received some irrigation.

Yields of the 55 hybrids grown at 16,000 plants at two locations (Newton and Poplarville) ranged from 39 to 65 bu/acre and averaged 51 bu (Table 6). Average yields of the same hybrids grown at 22,000 plants per acre at the same locations was 47 bu/acre and ranged from 30 to 66 bu (Table 7).

Root lodging in all harvested tests was very low. Stalk lodging at each plant population averaged 9%, with a range of 3 to 27% at 16,000 plants per acre and 1 to 24% at 22,000 plants per acre. Ear height averaged 3.1 ft in the tests at both plant populations.

The three-year average yields o the 19 hybrids that have been tested for three years at 16,000 plants per acre ranged from 58 to 7 bu/acre (Table 8). The three-yea average yields of the same hybrid at 22,000 plants per acre ranged from 54 to 79 bu/acre (Table 9).

Table 2. Summary of performance of 49 hybrids grown at two locations (Stoneville and Verona) at 16,000 plants per acre in the 1980 Mississippi hybrid corn performance trials.

			Lodging		Ear		
Hybrid	Brand	Yield	root	stalk	height	Moisture	Stand
no.		bu/A	%	%	cm.	%	%
JX247	Jacques	98.2	0	5	115	15.1	97
3147	Pioneer	94.9	0	11	124	15.0	99
T1230	Trojan	93.6	0	6	121	15.6	96
3160	Pioneer	90.9	0	2	120	14.7	95
G-4507A	Funk's	89.2	0	2	120	14.0	98
84aa	McCurdy	88.7	0	6	108	14.4	102
519	Pioneer	88.2	0	8	123	16.7	97
G-4606-1	Funk's	87.2	0	5	100	13.6	95
G-4747W	Funk's	86.9	0	10	123	17.0	100
8230	McCurdy	86.7	0	4	122	15.7	96
TXS115A	Trojan	86.0	0	4	116	13.3	97
G-4574	Funk's	85.7	0	3	121	13.1	98
22	Coker	85.2	0	4	122	15.1	96
X-300	McNair	84.9	0	13	113	15.0	100
XL72B	DeKalb	84.8	0	2	101	14.9	96
3369A	Pioneer	84.8	0	6	109	14.1	99
G-4709	Funk's	84.3	1	8	112	14.3	99
G-4689	Funk's	84.3	0	7	105	14.2	98
8150	McCurdy	83.9	0	3	130	15.4	96
USS1010	Agri-Chemicals	83.5	0	5	111	14.4	97
G-4787W	Funk's	82.3	0	3	134	16.2	100
3145	Pioneer	81.7	0	8	123	14.8	93
TXS114	Trojan	80.6	0	5	118	13.2	103
JX233	Jacques	80.3	0	4	111	13.8	98
SX200	Armstrong	80.3	0	9	119	13.7	96
G-4740	Funk's	79.5	0	7	104	15.8	98
3179	Pioneer	78.9	0	7	123	14.8	102
77	Coker	78.5	0	17	135	15.8	94
19	Coker	77.3	0	0	119	13.7	100
JX180	Jacques	77.0	0	4	120	13.5	100
XL390B	DeKalb	75.9	0	15	131	16.2	97
56	Coker	75.7	0	9	129	16.9	98
PX79	Northrup King	75.3	0	1	118	13.9	100
USS1515	Agri-Chemicals	75.2	0	5	98	14.3	98
XL71	DeKalb	75.0	0	3	116	13.4	101
USS0555A	Agri-Chemicals	74.3	0	3	108	13.4	95
PX707	Northrup King	73.0	0	7	122	14.8	92
PX87	Northrup King	72.6	0	8	120	15.2	98
19A	Coker	72.6	0	1	117	14.5	94
G-4848-1	Funk's	72.5	0	6	112	17.4	100
SX120W	Armstrong	69.7	1	11	124	16.7	93
XL82	DeKalb	69.2	0	3	125	14.8	97
PX95	Northrup King	69.1	0	16	129	14.7	94
PX83	Northrup King	66.8	0	7	118	15.3	95
PX723	Northrup King	66.5	0	8	126	15.4	101
JX227	Jacques	65.7	0	1	121	13.4	98
XL394	DeKalb	62.4	0	5	133	15.8	98
508	McNair	58.6	0	12	142	16.8	100
G-4776	Funk's	55.8	0	6	119	14.6	96
Mean		79.1	0	6	119	14.9	98

CV=20.31%

LSD (.05)=18.2 bu/A

Table 3. Summary of performance of 49 hybrids grown at three locations (Stoneville, Mississippi State, and Verona) at 22,000 plants per acre in the 1980 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk*	Moisture	Stand
no.		bu/A	%	%	cm.	no.	%	%
3160	Pioneer	96.0	0	7	116	75	14.8	97
JX180	Jacques	87.3	0	3	107	73	12.8	96
USS1010	Agri-Chemicals	85.5	0	3	106	73	12.8	97
USS0555A	Agri-Chemicals	83.7	0	1	101	76	13.2	93
G-4507A	Funk's	83.5	0	2	111	75	13.0	93
3147	Pioneer	82.9	0	6	120	81	14.6	95
19	Coker	82.2	0	3	108	73	13.4	92
8150	McCurdy	81.3	0	5	121	76	13.9	98
JX247	Jacques	81.3	0	4	103	78	14.7	96
84aa	McCurdy	79.8	0	4	111	74	14.8	97
T1230	Trojan	78.8	0	4	106	77	14.3	96
PX79	Northrup King	78.0	0	3	115	75	13.0	99
G-4740	Funk's	77.6	0	4	101	78	14.0	94
19A	Coker	77.5	0	4	111	75	13.9	92
TXS115A	Trojan	77.3	0	2	104	74	13.2	100
XL72B	DeKalb	77.2	0	3	102	75	13.9	97
TXS114	Trojan	77.0	0	4	111	74	12.8	96
G-4574	Funk's	76.4	0	5	110	74	13.3	95
PX87	Northrup King	76.2	0	6	103	77	14.2	98
JX233	Jacques	76.0	0	5	101	73	13.7	94
USS1515	Agri-Chemicals	75.7	0	2	99	76	14.9	93
3369A	Pioneer	75.6	0	4	105	73	13.2	97
XL394	DeKalb	75.6	0	8	123	82	15.3	90
G-4606-1	Funk's	74.9	0	4	103	74	14.0	89
77	Coker	74.7	0	15	120	82	15.4	95
22	Coker	73.8	0	8	106	76	13.9	92
G-4747W	Funk's	73.6	0	7	117	82	15.4	98
G-4848-1	Funk's	73.2	0	5	111	82	16.0	96
XL71	DeKalb	73.0	0	3	108	74	14.1	97
G-4689	Funk's	72.9	0	8	99	73	13.9	99
JX227	Jacques	72.2	0	4	113	77	13.1	93
X-300	McNair	72.0	0	14	109	77	14.5	91
PX83	Northrup King	71.7	0	5	110	75	13.8	97
519	Pioneer	71.3	0	8	115	78	15.3	100
G-4709	Funk's	70.5	0	5	107	78	14.4	96
SX200	Armstrong	70.3	0	12	109	76	13.5	94
SX120W	Armstrong	69.8	0	11	117	81	15.6	92
8230	McCurdy	69.2	0	5	115	78	15.9	91
PX723	Northrup King	68.1	0	9	120	79	14.5	94
XL82	DeKalb	67.8	0	6	119	76	15.2	94
3179	Pioneer	67.6	0	10	119	79	14.7	91
56	Coker	67.4	0	10	121	82	15.9	93
3145	Pioneer	67.3	0	4	109	77	15.4	91
508	McNair	66.0	0	14	129	85	16.9	95
G-4787W	Funk's	61.9	0	6	125	83	14.8	97
XL390B	DeKalb	59.5	0	11	118	78	14.3	93
PX707	Northrup King	59.1	0	7	112	77	14.1	96
PX95	Northrup King	56.5	0	8	122	79	13.5	97
G-4776	Funk's	51.0	0	5	115	79	14.1	98
Mean		73.8	0	6	112	77	14.3	95

CV=17.85%
LSD (.05)=12.2 bu/A

*Data for Mississippi State only

Table 4. Three year (1978-80) average performance of 16 hybrids grown in Area I at 16,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging		Ear height	Days to mid silk	Moisture	Stand
			root	stalk				
no.		bu/A	%	%	cm.	no.	%	%
3147	Pioneer	88.4	8	14	124	73	17.1	97
84aa	McCurdy	81.5	3	12	111	72	16.6	96
3145	Pioneer	81.1	5	8	146	74	17.2	96
PX95	Northrup King	79.0	11	17	132	77	17.2	97
22	Coker	78.9	6	9	117	73	16.7	96
3369A	Pioneer	78.7	6	10	130	73	16.1	96
3179	Pioneer	78.5	9	14	121	73	16.8	96
G-4574	Funk's	77.8	9	11	117	75	16.2	97
G-4709	Funk's	76.1	9	12	110	74	17.0	96
77	Coker	73.8	10	18	140	76	17.5	95
XL394	Dekalb	73.3	11	11	130	77	17.6	100
TXS114	Trojan	71.5	3	17	114	74	15.4	100
TXS115A	Trojan	69.8	9	14	113	72	16.4	95
56	Coker	68.2	3	16	124	76	17.8	99
PX723	Northrup King	67.1	8	11	125	75	16.8	103
G-4776	Funk's	65.4	7	8	124	76	16.8	98
MEAN		75.6	7	13	124	74	16.8	97

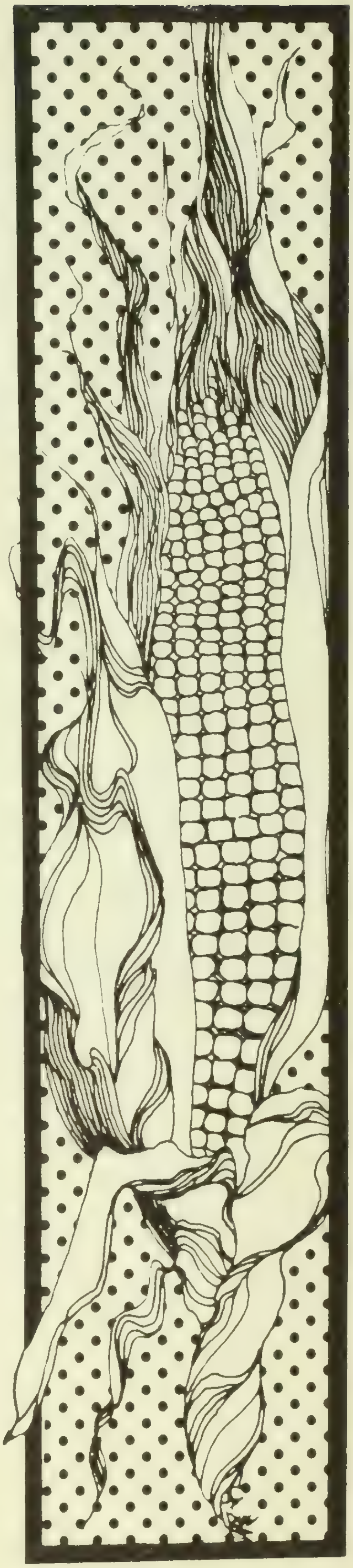
Table 5. Three year (1978-80) average performance of 16 hybrids grown in Area I at 22,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging		Ear height	Days to mid silk	Moisture	Stand
			root	stalk				
no.		bu/A	%	%	cm.	no.	%	%
84aa	McCurdy	81.7	3	13	114	74	16.5	95
3147	Pioneer	81.0	8	15	122	77	16.2	93
3145	Pioneer	78.8	4	9	121	76	16.9	94
22	Coker	75.1	4	12	113	74	16.1	95
TXS115A	Trojan	75.0	10	13	112	73	15.5	95
XL394	Dekalb	74.7	14	11	134	78	17.2	93
3369A	Pioneer	74.3	7	18	111	75	15.3	92
3179	Pioneer	73.2	8	20	123	75	16.2	94
G-4709	Funk's	72.7	10	12	112	75	16.4	94
G-4574	Funk's	72.2	9	15	116	76	15.6	94
TXS114	Trojan	70.3	4	17	111	75	15.7	93
56	Coker	69.7	5	13	123	76	17.1	94
PX723	Northrup King	69.7	11	13	124	75	18.1	92
G-4776	Funk's	67.9	8	11	126	75	16.3	97
PX95	Northrup King	67.0	11	9	130	77	16.1	93
77	Coker	66.7	13	14	134	78	17.0	92
MEAN		73.1	8	13	120	76	16.4	94

Table 6. Summary of performance of 55 hybrids grown at two locations (Newton and Poplarville) at 16,000 plants per acre in the 1980 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
no.		bu/A	%	%	cm.	%	%
T1230	Trojan	64.5	1	13	100	16.9	96
3160	Pioneer	64.4	0	18	97	16.2	91
3030	Pioneer	63.7	2	6	105	19.3	97
67-14	McCurdy	63.0	1	6	91	18.5	99
UC8951	Paymaster	62.2	0	6	104	17.5	103
3147	Pioneer	61.6	0	7	90	16.2	95
8150	McCurdy	60.3	2	5	98	15.2	100
USS2315	Agri-Chemicals	60.1	1	5	98	15.0	92
UC9532	Paymaster	58.2	2	16	98	16.1	93
PX79	Northrup King	58.0	0	6	96	15.3	97
519	Pioneer	57.8	1	3	102	17.8	96
PX723	Northrup King	57.3	1	8	102	19.9	96
G-4848-1	Funk's	57.2	0	5	89	19.5	98
JX227	Jacques	56.3	1	3	99	15.7	97
G-4740	Funk's	55.8	0	6	85	17.3	97
XL395A	Dekalb	55.6	4	8	102	19.6	90
77	Coker	55.4	1	10	117	19.9	97
UC12052A	Paymaster	54.8	1	3	95	20.1	91
84aa	McCurdy	54.5	0	14	89	15.7	99
3320	Pioneer	53.8	1	3	82	15.6	95
USS2020	Agri-Chemicals	53.2	0	7	89	17.1	95
XL82	Dekalb	53.1	0	4	109	16.6	96
G-4949A	Funk's	52.7	4	13	107	18.3	95
3145	Pioneer	52.7	0	13	89	16.8	95
9410	McCurdy	52.5	1	4	91	18.9	90
JX180	Jacques	51.5	0	8	90	14.9	94
G-4776	Funk's	50.5	0	3	97	16.8	93
G-4709	Funk's	50.4	1	8	92	16.6	96
USS1515	Agri-Chemicals	50.3	0	7	75	15.6	93
56	Coker	50.2	4	13	102	17.4	85
3040	Pioneer	49.9	3	7	87	20.2	93
PX95	Northrup King	49.0	1	6	102	17.1	91
19A	Coker	48.8	1	3	89	16.4	99
X-300	McNair	48.8	0	6	83	17.3	95
G-4606-1	Funk's	48.4	0	17	84	15.9	96
PX707	Northrup King	48.3	0	5	99	15.9	92
SX120W	Armstrong	47.8	1	13	100	17.7	88
PX87	Northrup King	47.6	0	11	90	16.6	93
19	Coker	47.6	0	4	86	15.0	90
G-4864	Funk's	47.3	0	6	93	18.0	98
TXS115A	Trojan	47.2	0	4	88	15.5	100
XL394	Dekalb	47.1	2	11	97	18.1	95
TXS114	Trojan	47.1	0	18	83	15.0	94
JX247	Jacques	44.9	0	18	86	16.3	97
G-4689	Funk's	44.9	3	18	86	16.4	87
3369A	Pioneer	44.8	0	11	78	16.2	93
G-5945	Funk's	44.2	1	15	103	19.4	88
UC9902	Paymaster	43.8	0	11	95	15.8	89
G-4747W	Funk's	42.2	0	17	89	17.5	92
PX83	Northrup King	42.1	0	14	84	16.0	95
SX200	Armstrong	41.4	0	12	88	16.4	95
22	Coker	39.6	0	10	84	15.8	93
XL390B	Dekalb	39.6	1	27	104	17.6	81
508	McNair	39.5	1	8	116	20.2	96
XL71	Dekalb	39.2	0	16	81	15.2	96
Mean		51.3	1	9	94	17.1	94

CV = 23.18%
LSD(.05) = 13.46 bu/A



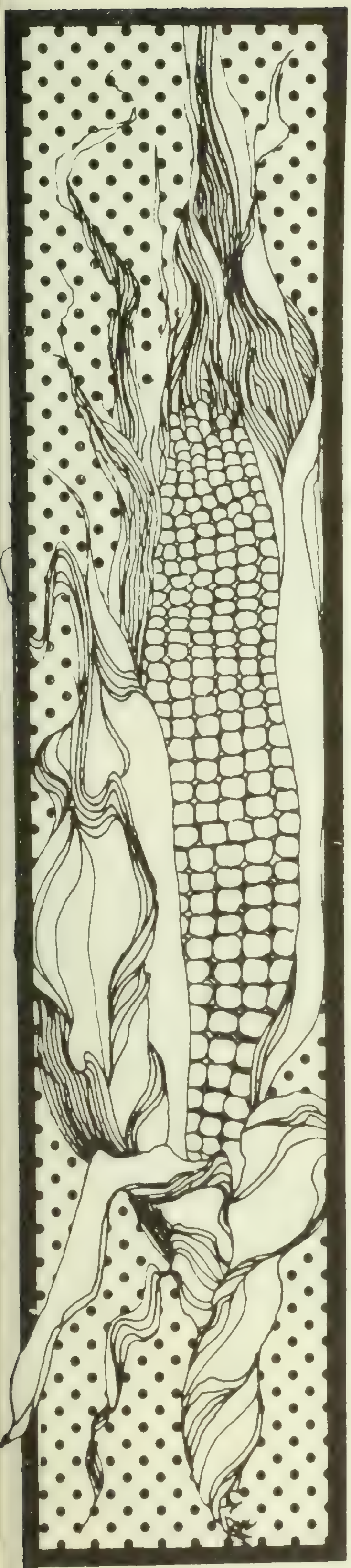


Table 7. Summary of performance of 55 hybrids grown at two locations (Newton and Poplarville) at 22,000 plants per acre in the 1980 Mississippi hybrid corn performance trials.

Hybrid no.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
		bu/A	%	%	cm.	%	%
3160	Pioneer	65.6	1	13	94	16.6	85
3320	Pioneer	61.1	0	4	80	16.8	90
3147	Pioneer	57.9	0	7	95	16.6	87
TXS114	Trojan	55.6	0	10	86	14.9	91
UC9532	Paymaster	55.6	0	7	97	16.6	89
XL395A	Dekalb	55.4	0	1	97	18.9	91
G-4740	Funk's	55.2	0	9	82	17.2	90
USS2315	Agri-Chemicals	53.1	0	10	100	17.3	90
19	Coker	53.1	0	7	87	15.6	91
USS1515	Agri-Chemicals	52.5	0	7	79	15.0	87
UC12052A	Paymaster	52.3	1	3	97	21.4	94
XL394	Dekalb	52.3	1	3	111	18.1	90
TXS115A	Trojan	51.9	0	7	88	15.6	93
USS2020	Agri-Chemicals	51.9	0	8	92	15.9	94
19A	Coker	51.9	1	11	94	15.1	89
PX723	Northrup King	51.8	0	8	106	17.5	87
3040	Pioneer	50.5	0	5	104	17.4	94
67-14	McCurdy	50.4	0	6	90	18.0	96
519	Pioneer	50.1	0	5	96	15.5	94
XL82	Dekalb	49.9	0	2	100	16.9	91
T1230	Trojan	49.9	0	11	87	16.0	87
3145	Pioneer	49.6	0	6	96	16.4	91
SX120W	Armstrong	49.2	0	4	97	17.8	91
8150	McCurdy	49.1	0	4	101	15.5	93
JX180	Jacques	49.0	1	6	91	15.6	86
UC8951	Paymaster	48.9	0	5	93	16.0	86
G-4689	Funk's	48.4	0	7	78	16.4	92
G-4606-1	Funk's	47.9	0	9	86	16.4	86
77	Coker	47.5	0	14	117	19.0	85
X-300	McNair	47.5	0	5	91	16.6	83
JX247	Jacques	47.2	0	8	95	16.5	93
22	Coker	47.1	0	13	89	17.1	89
3369A	Pioneer	46.1	0	9	85	15.4	91
84aa	McCurdy	45.9	0	21	91	15.9	89
G-4848-1	Funk's	45.9	2	2	95	20.0	100
PX79	Northrup King	45.9	1	3	92	15.2	92
G-4949A	Funk's	45.8	2	8	110	20.3	90
G-4709	Funk's	45.3	0	7	92	17.3	94
PX707	Northrup King	44.8	0	7	97	16.9	90
XL71	Dekalb	44.8	0	12	89	15.8	84
UC9902	Paymaster	44.5	0	15	91	16.1	86
9410	McCurdy	44.1	0	9	100	19.8	92
PX87	Northrup King	43.4	0	19	95	14.4	92
PX95	Northrup King	42.8	1	5	104	17.1	89
JX227	Jacques	42.3	1	2	95	16.1	92
508	McNair	42.2	0	19	115	20.9	88
3030	Pioneer	42.2	1	8	106	19.0	88
PX83	Northrup King	38.8	0	7	89	15.3	86
G-4776	Funk's	36.4	0	15	103	16.0	92
G-5945	Funk's	35.9	1	14	105	17.5	85
G-4864	Funk's	35.4	0	2	103	17.4	92
SX200	Armstrong	34.0	0	24	96	15.8	86
G-4747W	Funk's	33.7	0	9	97	16.6	89
XL390B	Dekalb	32.2	0	19	108	18.2	87
56	Coker	29.5	0	17	98	20.6	87
Mean		47.3	0	9	96	17.0	90

CV = 22.14%
LSD(.05) = 11.81 bu/A

Table 8. Three-year (1978-80) average performance of 19 hybrids grown in Area II at 16,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
no.		bu/A	%	%	cm	%	%
3147	Pioneer	76.4	5	9	103	16.5	96
67-14	McCurdy	74.0	16	10	99	19.1	96
3030	Pioneer	73.9	10	8	107	17.9	97
3145	Pioneer	68.2	3	10	100	17.2	94
77	Coker	67.1	7	8	125	18.8	96
G-4709	Funk's	66.8	7	8	101	17.3	96
3040	Pioneer	66.4	11	6	99	19.3	94
3369A	Pioneer	65.5	2	9	88	16.5	95
PX95	Northrup King	65.1	4	7	112	17.7	93
XL394	DeKalb	64.6	16	10	110	18.0	95
G-4949A	Funk's	64.4	13	11	117	18.3	95
PX79	Northrup King	63.0	4	6	100	16.0	95
22	Coker	62.6	2	11	97	16.4	93
PX723	Northrup King	62.1	6	12	104	17.7	93
G-4776	Funk's	60.3	6	8	106	17.2	93
TXS115A	Trojan	58.8	3	9	97	15.8	95
TXS114	Trojan	58.7	1	18	94	16.0	93
G-5945	Funk's	58.2	16	12	115	18.7	91
56	Coker	57.8	7	12	109	18.0	92
MEAN		64.9	7	10	104	17.5	94

Table 9. Three year (1978-80) average performance of 19 hybrids grown in Area II at 22,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
no.		bu/A	%	%	cm.	%	%
3147	Pioneer	78.7	10	7	106	17.4	90
3145	Pioneer	72.3	5	10	104	17.4	92
3040	Pioneer	72.1	17	7	110	18.3	94
XL394	DeKalb	71.9	18	9	114	18.5	91
TXS114	Trojan	70.0	6	17	94	15.9	92
22	Coker	70.0	7	16	101	17.6	92
67-14	McCurdy	70.0	22	19	98	18.7	91
TXS115A	Trojan	69.7	11	13	99	16.0	92
3369A	Pioneer	68.2	6	15	93	16.0	92
PX723	Northrup King	68.0	15	13	116	17.3	89
G-4709	Funk's	67.3	14	9	101	17.2	94
PX95	Northrup King	65.1	5	15	118	17.6	90
3030	Pioneer	65.1	17	9	118	19.4	90
77	Coker	63.3	16	14	130	19.2	90
G-4949A	Funk's	63.2	18	10	113	19.7	94
PX79	Northrup King	62.0	13	9	102	16.5	93
G-4776	Funk's	60.2	7	17	112	17.2	92
56	Coker	55.3	5	21	111	19.3	90
G-5945	Funk's	53.6	21	17	117	18.1	90
Mean		66.6	12	13	108	17.8	92

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1980 Mississippi Cotton Variety Tests

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1980 Mississippi Cotton Variety Tests

The cotton variety testing program in Mississippi is conducted to determine the relative performance of available varieties in different environments and to distribute the information to cotton producers throughout the state. The Mississippi Agricultural and Forestry Experiment Station does not recommend varieties but suggests that individual producers select a new variety on the basis of test results and then grow a small acreage to determine its adaptability and performance.

A major factor affecting yield and quality of cotton is the variety planted; however, yield and earliness of a given variety can be influenced by seed quality, planting date, cultural practices, fertilization, irrigation, weather, weed control and insect control. Yield usually receives first consideration, but other agronomic properties also may be important when selecting a cotton variety. Maturity becomes more important as one goes from the southern to the northern part of the state, particularly when planting is delayed. High seed viability and good seedling vigor help to insure uniform and adequate stands under adverse conditions. Reaction to diseases and insects merits additional consideration because several prevalent diseases can reduce yield of susceptible varieties.

Tests are conducted at various locations throughout the state but do not encompass all environmental conditions, disease and insect situations, soil differences and rainfall distributions that may be present throughout the state. The significant variety by location interactions measured in 1979 and 1980 indicate that varieties respond differently when grown in different locations. Observations of individual tests suggest that rainfall distribution, temperature, maturity, insect control and fertilization are important determinants of variety response.

The 1980 cotton variety tests were conducted in four Delta environments (Sumner, Tunica and two test sites at Stoneville) and three hill area environments (Holly Springs, Verona and Mississippi State).

Each entry was randomized and replicated six times. Yield determinations were based on the weight of cotton harvested from two-row plots. Determinations of lint percentage, boll size, seed index and fiber properties were made from hand-picked samples.

The same 15 varieties were evaluated in all Delta environments and 12 of the 15 were evaluated in the hill environments.

RESULTS

Delta, 1980

The test at Stoneville on a Bosket very fine sandy loam was planted April 21. Excessive rain and cool temperatures immediately after planting resulted in slow stand establishment. This was followed by dry weather throughout the year, which resulted in the test being irrigated twice (July 11 and August 4). The test was harvested twice and lint yields ranged from 775 to 1053 lbs/acre. Maturity at first harvest on September 16 ranged from 81 to 91% (Table 1).

The Tunica test was planted May 1 on a Dundee sandy loam and good stands were obtained. The test was harvested on October 22 and lint yields ranged from 494 to 661 lbs/acre (Table 2). Varieties at this location produced shorter plants, shorter fiber, and lower yields than at the other locations.

The Sumner test on a Dubbs sandy loam was planted April 30. The test was harvested twice, and earliness at first harvest on October 8 ranged from 80 to 93%. Lint yields ranged from 658 to 794 lbs/acre (Table 3). Yields at Sumner were about 40% lower than in 1979 as a result of inadequate moisture and reduced boll size. Average boll size in 1979 was 5.49 (83 bolls per pound) compared to 4.31 (105 bolls per pound) in 1980. High temperatures caused pollen sterility that resulted in flat-sided bolls with a reduced number of locks. The occurrence of flat-sided bolls ranged from 14 to 42%, which appeared to cause a delay in maturity but did not significantly affect variety performance. The percentage of flat-sided bolls was lowest for Deltapine 61 and highest for McNair 235, but lint yield of the two varieties was practically identical.

The test at Stoneville on a mixed soil was planted April 23. The test was irrigated on July 11 and harvested on October 7. Lint yields ranged from 539 to 736 lbs/acre (Table 4). The occurrence of flat-sided bolls ranged from 7 to 26%, compared to the range of 5 to 33% for the Stoneville test on sandy loam soil, and the difference apparently occurred because the Stoneville tests were irrigated and the Sumner test was not. McNair 235 had the highest percentage of flat-sided bolls at all locations.

Average yield of the 15 varieties that were tested in the four Delta environments in 1980 ranged from 626 to 781 lbs/acre, and maturity at first harvest ranged from 81 to 91% (Table 5). Lint yield and boll size were lower in 1980 than in 1979. Lint yield in 1979 ranged from 779 to 1002 lbs/acre, and it took 83 bolls for a pound of cotton in 1979, 101 bolls for a pound of cotton in 1980.

Delta; two-year and three-year averages

Average lint yield of the 13 varieties grown in eight Delta environments over a two-year period (1979-80) ranged from 741 to 888 lbs/acre (Table 6). Earliness at first harvest ranged from 77 to 85%.

Average lint yield of the 11 varieties grown in 11 Delta environments over the three-year period (1978-80) ranged from 836 to 939 lbs/acre (Table 7). Maturity at first harvest ranged from 78 to 83%.

HILL AREA, 1980

The test site on a Grenada silt loam at Holly Springs was limed in the spring and 13-13-13 (600 lbs/acre rate) was applied in the bottom of a middle buster furrow before rebedding. The test was planted May 2 and no additional nitrogen was applied. Five insecticide applications were made from May 21 to August 22. Rainfall from May through August totaled about 12.8 inches.

The test was harvested twice, and maturity at first harvest on September 23 ranged from 74 to 83%. Lint yields ranged from 690 to 887 lbs/acre (Table 8).

The Verona test on a Catalpa clay loam was fertilized (60-34-68 lbs/acre) before planting on May 14. A sidedress application of 30-0-0/acre was made, and five insecticide applications were made for control of the boll weevil and the boll worm. The test was harvested on October 16, and lint yields ranged from 457 to 617 lbs/acre (Table 9).

The test at Mississippi State on a Leeper clay loam was planted April 22 and harvested September 15 Lint yields ranged from 1029 to 1168 lbs/acre (Table 10).

Hill Area; one-year, two-year and three-year averages

Average lint yield of the 12 varieties grown in the three hill-area environments in 1980 ranged from 756 to 853 lbs/acre (Table 11). Yields of the nine varieties grown at the three locations for two years (1979-80) ranged from 668 to 792 lbs/acre, and the average yields of the eight varieties grown at the three locations for three years (1978-80) ranged from 733 to 783 lbs/acre. The three-year average yield of each variety was highest at Mississippi State, intermediate at Holly Springs and lowest at Verona.

Average lint yields and earliness of the varieties tested at Holly Springs for two, three and four years are presented in Table 12.

Table 1. Results of 1980 Cotton Variety Test on a Bosket very fine sandy loam soil at Stoneville, MS.

	LBS LINT PER ACRE						FIBER PROPERTIES					
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire	Plant height (in.)
DES 422	1053	903	86	37.4	10.2	4.54	1.15	.57	20.09	5.4	4.6	35.6
DES 56	1040	889	85	37.5	10.2	4.48	1.15	.59	21.72	5.3	4.7	36.9
DES 422-8	1003	872	87	37.5	9.8	4.67	1.13	.59	21.58	5.0	4.9	34.1
Deltapine 61	997	876	88	37.0	10.7	4.96	1.19	.63	20.87	6.3	5.2	40.6
McNair 235	992	830	84	36.7	10.5	4.61	1.13	.57	21.43	5.2	4.7	36.5
Stoneville 213	982	860	87	37.5	10.6	4.58	1.16	.59	19.60	5.8	5.1	37.9
Stoneville 825	967	878	91	36.2	10.5	4.68	1.14	.56	18.83	5.1	5.0	38.6
Deltapine 41	954	848	89	41.3	8.8	4.30	1.15	.59	19.39	5.4	4.7	34.8
Deltapine 26	914	788	86	39.7	9.9	4.36	1.15	.59	21.29	5.6	5.0	39.9
Stoneville 506	910	807	89	34.9	11.1	4.60	1.16	.59	21.36	5.5	5.1	34.9
Deltapine 55	907	784	86	38.1	9.7	4.76	1.18	.60	19.88	5.0	4.7	35.4
Coker 304	844	721	85	36.4	11.0	4.77	1.18	.60	20.38	5.0	4.6	36.2
Coker 3131	833	674	81	37.9	11.8	4.42	1.15	.59	20.66	6.0	4.8	38.4
Coker 315	823	694	84	36.8	10.7	4.81	1.20	.61	21.79	5.2	4.8	39.3
Coker 310	775	675	87	35.2	11.3	5.10	1.18	.58	21.15	5.0	4.6	39.1
C.V.	8.0											
LSD .05	85											

Planted: April 21, 1980
Harvested: September 16 and October 20, 1980
Irrigated: July 11 and August 4, 1980

Table 2. Results of 1980 Cotton Variety Test on a Dundee sandy loam soil at Tunica, MS.

	LBS LINT PER ACRE	Lint	Seed	Boll size	FIBER PROPERTIES				
					Length		Strength	Elonga-	Micro-
	Total	percent	index	grams	2.5%	50%	g/tex	tion	naire
Stoneville 825	661	40.0	10.1	4.58	1.06	.51	18.75	5.0	5.4
Stoneville 213	625	39.5	10.1	4.85	1.07	.53	19.39	5.3	5.2
Deltapine 26	611	41.9	9.4	4.69	1.07	.54	20.17	5.3	5.6
DES 56	609	39.4	10.1	4.62	1.07	.53	19.67	5.4	5.2
Coker 3131	607	40.9	11.3	4.53	1.06	.54	20.24	6.2	5.0
DES 422	604	40.6	9.5	4.61	1.05	.53	18.32	5.3	4.9
Deltapine 61	583	38.7	10.4	5.08	1.08	.54	19.96	6.1	5.6
Coker 315	561	39.1	11.1	5.16	1.11	.56	20.45	5.9	5.0
Coker 304	559	38.2	11.3	5.40	1.11	.57	21.02	5.1	5.0
Deltapine 41	557	42.1	9.2	4.48	1.07	.54	19.39	5.0	5.1
Deltapine 55	551	41.3	9.2	4.74	1.07	.54	18.25	5.2	5.0
DES 422-8	549	39.7	9.7	4.44	1.05	.53	19.74	5.1	5.4
Stoneville 506	547	38.4	10.4	4.26	1.07	.52	18.53	5.3	5.1
Coker 310	527	37.6	10.6	5.66	1.11	.55	19.74	5.1	4.9
McNair 235	494	39.3	9.9	4.72	1.07	.54	20.17	5.0	5.0
C.V.	13.8								
LSD .05	91								

Planted: May 1, 1980
Harvested: October 22, 1980

Table 3. Results of 1980 Cotton Variety Test on a Dubbs sandy loam soil at Sumner, MS.

	LBS LINT PER ACRE			Lint	Seed	Boll size	FIBER PROPERTIES				
							Length		Strength	Elonga-	Micro-
	Total	First pick	Percent first pick	percent	index	grams	2.5%	50%	g/tex	tion	naire
Stoneville 213	794	703	89	37.2	10.8	4.38	1.14	.58	21.17	6.5	5.2
Stoneville 825	789	725	92	37.9	10.5	3.97	1.12	.55	19.66	5.0	4.9
Coker 3131	784	636	81	37.7	12.0	4.27	1.15	.59	20.31	6.6	4.7
Deltapine 26	782	702	90	39.7	9.3	4.17	1.11	.56	21.75	6.2	5.1
DES 422	770	662	86	37.9	10.0	3.97	1.14	.60	19.30	5.7	4.6
DES 56	765	630	82	36.6	10.7	4.16	1.15	.60	21.53	6.2	4.9
Deltapine 61	764	705	92	36.4	10.4	4.67	1.16	.58	20.88	7.6	5.1
McNair 235	756	604	80	37.3	10.4	4.12	1.13	.61	21.38	5.4	5.0
DES 422-8	735	615	84	36.7	10.9	4.14	1.16	.62	21.17	5.7	4.9
Stoneville 506	722	669	93	35.2	11.1	4.20	1.16	.59	20.81	6.0	4.6
Deltapine 41	703	633	90	40.0	9.0	3.95	1.14	.58	21.03	5.2	4.6
Deltapine 55	693	633	91	38.0	9.8	4.08	1.15	.55	20.16	6.1	4.5
Coker 315	685	632	92	35.1	11.9	4.57	1.20	.61	22.18	5.6	4.3
Coker 304	667	605	91	34.2	11.9	4.81	1.22	.62	22.47	6.0	4.3
Coker 310	658	599	91	34.3	12.2	4.95	1.19	.59	22.11	6.0	4.5
C.V.	8.3										
LSD .05	69										

Planted: April 30, 1980
Harvested: October 8 and 23, 1980

Table 4. Results of 1980 Cotton Variety Test on a mixed soil at Stoneville, MS.

	LBS LINT PER ACRE			Boll	FIBER PROPERTIES				
					Length				
	Total	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
Deltapine 41	736	43.1	8.3	3.83	1.14	.59	19.74	7.1	5.0
Stoneville 506	719	36.9	10.1	4.12	1.13	.55	20.31	7.5	5.0
Stoneville 825	709	38.7	10.0	3.90	1.09	.55	18.82	5.5	5.1
Deltapine 26	705	41.5	8.8	4.09	1.11	.58	21.30	6.3	5.2
Deltapine 61	692	39.8	9.7	4.55	1.14	.60	21.37	8.1	5.2
DES 422	667	39.3	9.6	3.89	1.14	.58	20.24	6.4	4.9
DES 56	662	38.4	10.3	3.99	1.13	.58	22.30	7.4	5.0
Coker 315	639	39.3	9.7	4.43	1.16	.61	20.88	6.0	4.8
Stoneville 213	628	39.1	9.9	4.15	1.12	.59	19.67	7.6	5.2
Deltapine 55	628	40.3	9.3	4.03	1.12	.57	19.46	7.2	4.7
McNair 235	573	38.1	10.5	3.80	1.12	.58	22.72	6.5	4.9
DES 422-8	570	38.5	9.8	3.97	1.15	.61	20.95	6.5	5.0
Coker 304	560	37.8	10.3	4.45	1.16	.60	21.87	6.7	4.7
Coker 310	544	37.0	10.5	4.60	1.18	.61	22.72	6.2	4.7
Coker 3131	539	40.1	10.7	4.17	1.13	.60	21.37	6.9	4.7
C.V.	13.8								
LSD .05	101								

Planted: April 23, 1980
Harvested: October 7, 1980
Irrigated: July 11, 1980

Table 5. Average performance of 15 cotton varieties in four Delta environments[1/] in 1980.

	LBS LINT PER ACRE					FIBER PROPERTIES				
						Length				
	Total	Percent first pick	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elongation	Micronaire
Stoneville 825	781	91	38.2	10.3	4.28	1.10	.54	19.01	5.1	5.1
DES 422	773	86	38.8	9.8	4.24	1.12	.57	19.49	5.7	4.7
DES 56	769	84	37.9	10.3	4.33	1.12	.57	21.30	6.1	4.9
Deltapine 61	759	90	38.0	10.3	4.81	1.14	.59	20.77	7.0	5.3
Stoneville 213	757	88	38.3	10.3	4.49	1.12	.57	19.96	6.3	5.2
Deltapine 26	753	88	40.7	9.3	4.32	1.11	.57	21.13	5.8	5.2
Deltapine 41	737	89	41.6	8.8	4.14	1.12	.57	19.89	5.7	4.8
Stoneville 506	724	91	36.3	10.7	4.29	1.13	.56	20.25	6.1	4.9
DES 422-8	714	85	38.1	10.0	4.30	1.12	.59	20.86	5.6	5.0
McNair 235	704	82	37.8	10.3	4.31	1.11	.57	21.42	5.5	4.9
Deltapine 55	695	88	39.4	9.5	4.40	1.13	.56	19.44	5.9	4.7
Coker 3131	691	81	39.1	11.4	4.35	1.12	.58	20.64	6.4	4.8
Coker 315	677	88	37.6	10.8	4.74	1.17	.60	21.32	5.7	4.7
Coker 304	657	88	36.6	11.1	4.86	1.17	.60	21.43	5.7	4.6
Coker 310	626	89	36.0	11.1	5.08	1.16	.58	21.43	5.6	4.7
LSD .05	43									

[1/] Four environments - Stoneville 2, Tunica 1, Sumner 1.

Table 6. Performance of 13 cotton varieties grown in eight Delta environments[1], 1979-80 average.

	LBS LINT PER ACRE					FIBER PROPERTIES					Plant height (in.)[2]
	Total	Percent first pick	Lint percent	Seed index	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire	
DES 422	888	84	38.9	10.2	4.70	1.13	.57	19.18	7.2	4.5	39.9
Stoneville 825	873	81	38.0	10.8	4.77	1.12	.56	18.98	6.2	4.9	43.9
DES 56	864	82	37.9	10.6	4.80	1.13	.57	20.61	7.5	4.7	41.4
Deltapine 41	849	82	41.4	9.2	4.73	1.13	.57	19.76	7.0	4.6	40.4
Stoneville 506	837	85	36.9	11.0	4.82	1.13	.57	19.48	7.5	4.6	39.2
Stoneville 213	804	80	37.8	10.7	5.00	1.13	.57	19.22	7.6	4.9	43.4
Deltapine 55	802	82	39.5	9.9	4.93	1.13	.56	18.81	7.2	4.5	42.0
McNair 235	799	80	37.9	10.7	4.87	1.12	.58	20.54	6.4	4.7	40.5
Deltapine 61	796	79	38.3	10.5	5.25	1.14	.58	20.02	8.4	4.9	46.4
Deltapine 26	791	77	40.3	9.8	4.74	1.12	.57	20.28	7.4	4.9	45.7
Coker 315	771	80	38.3	10.8	5.15	1.19	.60	20.76	6.5	4.6	45.0
Coker 304	754	81	37.4	11.1	5.30	1.18	.60	20.83	6.6	4.5	44.0
Coker 310	741	82	36.9	11.3	5.43	1.18	.59	20.81	6.7	4.5	44.4
C.V.	6.9		1.80	3.30	3.00	1.20		2.90		2.82	
LSD .05	54		0.70	0.34	0.15	0.01		0.57		0.13	

[1] Eight environments - Stoneville 4, Tunica 2, Sumner 2.

[2] Plant height at Stoneville.

Table 7. Performance of 11 cotton varieties grown in 11 Delta environments[1], 1978-80 average.

	LBS LINT PER ACRE					FIBER PROPERTIES				
	Total	Percent first pick	Lint percent	Seed index	Boll size grams	Length 2.5%	Length 50%	Strength g/tex	Elongation	Micronaire
DES 56	939	83	37.9	10.7	4.87	1.14	.58	20.26	7.7	4.7
Stoneville 825	927	82	38.0	10.9	4.90	1.13	.56	18.83	6.3	4.9
Deltapine 41	923	83	41.3	9.3	4.83	1.14	.57	19.79	7.1	4.6
McNair 235	912	81	38.2	10.8	5.01	1.13	.58	20.20	6.5	4.7
Deltapine 26	896	78	40.5	10.0	4.85	1.12	.57	20.06	7.5	4.9
Stoneville 213	884	80	37.6	10.9	5.13	1.13	.57	19.06	7.7	4.9
Deltapine 61	878	79	38.2	10.5	5.34	1.15	.58	20.00	8.8	4.9
Deltapine 55	877	83	39.5	10.0	4.99	1.14	.56	18.77	7.4	4.5
Coker 315	856	80	38.4	10.9	5.21	1.19	.60	20.60	6.9	4.6
Coker 310	840	82	37.1	11.4	5.54	1.19	.59	20.65	6.8	4.5
Coker 304	836	81	37.4	11.2	5.38	1.18	.59	20.80	6.7	4.5

[1] Eleven environments - Stoneville 5, Tunica 3, Sumner 3.

Table 8. Results of 1980 Cotton Variety Test on a Grenada silt loam soil at Holly Springs, MS.

	LBS LINT PER ACRE						FIBER PROPERTIES				
							Length				
	Total	First pick	Percent first pick	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elonga-tion	Micro-naire
McNair 235	887	741	83	38.8	10.4	4.83	1.12	.54	21.87	5.5	5.1
Coker 315	774	639	82	39.3	11.0	4.91	1.14	.56	21.37	5.7	5.3
Deltapine 41	762	594	78	42.6	9.5	4.48	1.11	.53	20.59	6.0	5.7
Stoneville 825	762	623	82	38.9	10.5	4.85	1.09	.52	19.45	5.0	5.8
DES 422	748	610	82	39.8	10.0	4.99	1.11	.53	20.31	5.2	5.1
DES 56	747	618	83	39.0	10.5	4.38	1.14	.57	20.87	6.7	5.1
Stoneville 213	746	584	78	38.9	10.7	4.82	1.10	.54	20.38	7.2	5.6
Coker 310	724	568	78	38.6	11.2	5.04	1.12	.53	20.09	5.4	5.2
Coker 3131	708	527	74	41.2	11.8	4.48	1.11	.53	20.37	6.8	5.2
Stoneville 506	708	589	83	36.5	11.7	4.62	1.14	.55	20.66	6.3	5.3
Deltapine 61	699	535	76	38.4	10.9	4.64	1.10	.53	20.24	7.9	5.8
Deltapine 55	690	545	79	39.6	10.1	4.72	1.11	.53	20.37	6.2	5.3
C.V.	8.0										
LSD .05	69										

Planted: May 2, 1980
Harvested: September 23 and October 16, 1980
Fertilizer: 600 pounds 13-13-13

Table 9. Results of 1980 Cotton Variety Test on a Catalpa silty clay soil at Verona, MS.

	LBS LINT PER ACRE				FIBER PROPERTIES				
					Length				
	Total	Lint percent	Seed index	Boll size grams	2.5%	50%	Strength g/tex	Elonga-tion	Micro-naire
Deltapine 41	617	42.8	8.5	4.24	1.10	.52	19.60	5.4	4.9
Deltapine 61	611	40.4	10.0	4.90	1.11	.55	20.45	7.2	5.6
DES 56	602	40.1	9.6	4.55	1.13	.53	19.03	6.5	4.9
Stoneville 825	594	40.5	10.1	4.26	1.09	.51	17.11	5.4	5.2
Stoneville 506	584	40.2	9.8	4.28	1.11	.50	17.96	6.3	4.6
DES 422	547	41.6	9.4	4.36	1.10	.52	17.46	5.9	4.7
Stoneville 213	509	39.8	9.9	4.90	1.11	.54	19.24	6.6	5.4
Coker 3131	505	42.0	10.6	4.73	1.09	.51	19.03	7.1	4.7
McNair 235	504	39.9	9.9	4.49	1.10	.51	18.10	5.8	5.0
Coker 315	486	39.5	10.3	5.07	1.15	.55	20.52	5.7	4.6
Deltapine 55	462	42.7	9.0	4.40	1.08	.52	17.46	5.6	4.9
Coker 310	457	38.2	10.6	4.83	1.13	.54	20.44	6.1	4.8
C.V.	14.3								
LSD .05	97								

Planted: May 14, 1980
Harvested: October 16, 1980

Table 10. Results of 1980 Cotton Variety Test on Leeper silty clay loam soil at Mississippi State, MS.

	LBS LINT PER ACRE	Lint	Boll size	FIBER PROPERTIES				
				Length		Strength	Elonga-	Micro-
	Total	percent	grams	2.5%	50%	g/tex	tion	naire
Coker 310	1168	37.8	5.44	1.19	.57	23.64	6.7	5.1
McNair 235	1167	38.5	5.31	1.15	.56	22.64	7.1	5.4
Coker 3113	1157	40.5	5.96	1.12	.55	21.39	7.4	5.2
Coker 315	1154	39.4	5.11	1.15	.55	21.83	6.7	5.3
Deltapine 41	1138	40.2	4.92	1.13	.56	23.06	7.6	5.6
Deltapine 55	1117	39.2	5.40	1.16	.55	20.65	7.3	5.6
Stoneville 213	1107	36.6	5.78	1.16	.55	20.90	7.9	5.6
Stoneville 506	1101	36.4	5.33	1.19	.58	22.71	8.4	5.3
Stoneville 825	1065	37.2	5.28	1.17	.55	21.76	6.3	5.6
DES 422	1047	37.6	5.12	1.16	.56	22.35	7.6	5.0
Deltapine 61	1033	36.4	5.67	1.15	.56	22.27	8.7	6.0
DES 56	1029	36.4	4.59	1.19	.58	21.53	7.9	5.2
C.V.	7.5							
LSD .05	96							

Planted: April 22, 1980
Harvested: September 15, 1980

Table 11. Average lint yield of the varieties grown in three hill-area environments for one, two and three years.

	DES 56	Stv. 825	Stv. 213	DP 41	DP 55	DP 61	Coker 310	Coker 315	McNair 235	Stv. 506	DES 422	Coker 3131
							lbs					
3-Yr. Ave. (1878-80) Verona	487	463	464	488	446	472	440	411	---	---	---	---
3-Yr. Ave. (1978-80) Holly Springs	787	782	742	773	770	702	781	751	---	---	---	---
3-Yr. Ave. (1978-80) Miss. State	1056	1081	1055	1088	1080	1026	1041	1074	---	---	---	---
3-Yr. Ave. (1978-80) 3 Locations*	777	775	754	783	765	733	754	745	---	---	---	---
2-Yr. Ave. (1979-80) 3 Locations*	728	726	688	726	683	668	697	711	792	---	---	---
1-Yr. Ave. (1980) 3 Locations*	793	807	787	839	756	781	783	805	853	798	781	790

***Verona, Holly Springs, Mississippi State.**

Table 12. Average lint yield and earliness of the varieties grown for two, three and four years at Holly Springs.

	2-YEAR AVE. 1979-80		3-YEAR AVE. 1978-80		4-YEAR AVE. 1977-80	
	Lint per acre	Percent first pick	Lint per acre	Percent first pick	Lint per acre	Percent first pick
			lbs			
DES 56	702	77	787	73	774	73
Coker 310	708	73	781	66	746	68
Deltapine 55	659	73	770	66	744	67
Stoneville 213	659	70	742	64	724	65
Deltapine 61	603	65	702	64	683	69
Stoneville 825	703	75	782	68	---	--
Deltapine 41	708	72	773	65	---	--
Coker 315	710	73	751	66	---	--
McNair 235	815	80	---	--	---	--

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Influence of Row Spacing on New DES Cotton Varieties and Strains

JUL 09 1981
Mississippi State, University

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1878

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All with the MAFES Delta Branch

Influence of Row Spacing on New DES Cotton Varieties and Strains

Cotton traditionally has been planted on 38- and 40-inch rows in the Delta of Mississippi because row-width standardization has been essential to mechanization of all cotton production practices. However, narrow-row cotton has been grown in tests on the Texas High Plains since 1954 (11). Development of finger-type strippers (3,11,16,20) stimulated interest in research to develop narrow-row production systems (8,15,17,19), and introduction of an experimental "cotton combine" in 969 (9) increased the technical easibility of harvesting cotton grown in narrow rows (5,12,14,18).

Research at the MAFES Delta Branch in the late 1950s and early 1960s evaluated cotton yields on 20-, 40-, 60- and 80-inch rows(10). Bridge et al (5) reported that lint production of three commercial cotton varieties tested for three years averaged 9% more on 30-inch rows and 6% more on 15-inch rows than on 40-inch rows. However, the normal growing season for current cotton varieties and days suitable for harvesting in most years pose a severe restriction on producing cotton on narrow rows in the Mississippi River Delta (4) because of the requirement for once-over harvesting.

Ray (15) and Niles (13) emphasized that the potential of narrow-row production could not be realized until suitable varieties were developed. Bridge and Chism (6,7) released two early maturing, high-yielding varieties in 1978. Anderson et al (1) evaluated these varieties on farms in the Delta of Mississippi before they were released and reported that they matured 14 days earlier and yielded 8% more than conventional varieties. Also, a larger acreage could be handled with the same equipment complex, with net income from the total acreage increased about $20/acre.

The study reported here was designed to determine the earliness and yield of early maturing strains grown in conventional and narrow rows.

Materials and Methods

The effect of row spacing on five early maturing strains[1] and one commercial variety was studied at the MAFES Delta Branch for three years (1974-76). We used a split plot design with five replications. Main plots were "varieties" and subplots were row spacings. Each plot was 75 ft long with six rows at 40-inch spacing or 15 rows at 15-inch spacing.

The early maturing "varieties" in the trial were DES-21326-04 (designated DES 04), DES-2134-018 (DES 18), DES 2134-056 ('DES 56'), DES B8-32 (DES 32), DES 88-11-10 (DES 10) and DES 06-020-24 ('DES 24'). The standard commercial variety, 'Stoneville 213', was used as the control.

Seedbeds were prepared either in fall or spring by subsoiling, disking, applying Treflan® and disking. The plots planted to 40-inch rows were hipped twice, and the plots planted to 15-inch rows were left flat. All seedbeds were conditioned with a "do-all" ahead of the planters, and a 32% urea-ammonium nitrate solution was applied at planting to supply nitrogen at the rate of 80 lbs/acre.

The 40-inch rows were planted with a six-row Burch planter equipped with 5/8-inch-wide experimental sword openers. The 15-inch rows were planted with 15 John Deere 71-B flexi-planter units spaced 15 inches apart on the toolbar, with 20-inch spacing directly behind the tractor tires. Acid-delinted seed were planted at the rate of 25 lbs/acre on May 3, 14 and 10 in 1974, 1975 and 1976, respectively.

Fluometuron was applied preemerge at labeled rates (20-inch band on the 40-inch rows and broadcast on the plots planted to 15-inch rows). Weed control was accomplished on the 40-inch rows by cultivation plus post-directed spray of diuron and MSMA (five cultivations and two spray applications in 1974, five cultivations and three spray applications in 1975, four cultivations and two spray applications in 1976). The 15-inch rows were not cultivated but received two post-directed spray applications of diuron and MSMA in 1974, one in 1975 and in 1976.

Insecticides were applied by air as needed throughout the growing season. Defoliants were applied when the cotton matured in late September each year.

We marked off a 10-ft section of

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[1] All strains and varieties are referred to as "varieties" throughout the remainder of this bulletin. All DES entries were MAFES strains when the study was conducted. DES 2134-056 was released as 'DES 56' in 1978 (7) and DES 06-020-24 was released as 'DES 24' in 1978 (6). DES 89-11-10 was tested in 1974 only. DES 06-020-24 was not tested in 1974 but was tested in 1975 and 1976.

one row in each plot and hand harvested the open bolls at intervals of about one week. All green bolls on each 10-ft row section were removed just before harvesting the center four rows of each 40-inch-row plot and a 13-ft-wide swath from each 15-inch-row plot with a cotton combine.

All green bolls on each 10-ft row section were removed just before harvesting, and the amount of seed cotton in the green bolls was estimated.[2] Total seed cotton yield of each 10-ft row section was determined by summing the hand-harvested yield and the amount of cotton in the green bolls. Yields at each harvest (cumulative) were expressed as the percentage of total yield of each 10-ft row section, and time to 80% open was determined by plotting percentages of open cotton against time.

Samples of the seed cotton harvested from each plot with the cotton combine were collected, and the samples of each replicate were blended into a composite sample for each treatment. Large sticks were removed by hand to facilitate handling in the small tower drier of the micro-gin, and all samples were ginned on a 20-saw gin with a standard equipment sequence.[3]

Lint samples were graded by personnel of the Cotton Division of the Agricultural Marketing Service, USDA, Greenwood, Mississippi.

Results and Discussion

The first of seven harvests in 1974 was on September 9, and the percentages of total seed cotton yields that were open on each harvest date (averages of both row spacings) were significantly lower (P <.05) for DES 10 and Stoneville 213 than for the other "varieties" tested (Table 1). Maturity averaged

Table 1. Influence of row spacing on earliness of six cotton "varieties", MAFES Delta Branch, 1974.

Variety	Row spacing	Dates of Hand Harvest[1]						
		9/9	9/16	9/23	10/1	10/8	10/17	10/21
	(inches)	-% of Seed Cotton Open-						
DES 04	40	37.3	60.5	74.3	81.9	89.8	94.2	95.9
	15	46.9	61.5	78.8	86.8	92.2	94.7	95.7
	Average	42.1a[2]	61.0a	76.6a	84.4a	91.0a	94.5a	95.8a
DES 18	40	39.4	56.5	72.6	80.0	88.0	92.3	93.8
	15	46.6	60.4	70.4	77.6	87.9	95.4	96.8
	Average	43.0a	58.4a	71.5a	78.8a	88.0a	93.9a	95.3a
DES 56	40	39.5	60.2	74.5	80.2	88.1	92.4	94.3
	15	42.7	58.4	78.3	83.1	89.3	93.6	95.9
	Average	41.1a	59.3a	76.4a	81.6a	88.7a	93.0a	95.1a
DES 32	40	34.8	59.2	72.9	79.9	88.0	93.7	95.6
	15	43.6	67.1	78.4	84.3	90.4	92.8	94.5
	Average	39.2a	63.2a	75.7a	82.1a	89.2a	93.3a	95.1a
DES 10	40	13.1	29.4	40.0	46.7	62.0	76.3	81.3
	15	24.8	39.5	50.2	56.4	71.3	85.8	90.5
	Average	19.0b	34.5b	45.1b	51.5b	66.6b	81.0b	85.9b
Stoneville 213	40	18.5	36.2	49.7	56.7	69.6	80.0	83.6
	15	24.2	44.8	60.5	68.1	79.6	87.7	91.7
	Average	21.4b	40.5b	55.1b	62.4b	74.6b	83.8b	87.6b
Row Spacing (inches)								
40 (Average all varieties)		30.4b	50.3	64.0b	70.9b	80.9b	88.2b	90.8b
15 (Average all varieties)		38.1a	55.3	69.4a	76.1a	85.1a	91.7a	94.2a

[1] A 10-foot section of row was harvested by hand on the dates listed.

[2] Means in the same column followed by the same letter do not differ significantly (P <.05) as determined by Duncan's new multiple range test.

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[2] *Fifty bolls that opened after harvest were used to estimate the amount of seed cotton in all green bolls from each 10-ft row section.*

[3] *The samples were ginned at the USDA Cotton Ginning Research Laboratory at Stoneville, Mississippi.*

over all "varieties" was significantly earlier with the narrower row spacing on six of seven harvest dates. Differences in the relative earliness of maturity at first harvest were more pronounced for DES 04, DES 18, DES 32 and DES 56 than for DES 10 and Stoneville 213.

Percentages of total seed cotton yields that were open at the first harvest on September 8, 1975 (averages of both row spacings) were significantly higher for DES 04, DES 18 and DES 56 than for Stoneville 213, and DES 04 was earlier than Stoneville 213 until the October 16 harvest date (Table 2). DES 32 was later than all other "varieties" after October 1 but was more storm resistant. DES 04 was earlier than DES 32 and DES 24 on all seven harvest dates.

Maturity (average of all "varieties") at each harvest date in 1975 was earlier for the wider row spacing[4], and the differences were significant on the September 8 and October 8 harvest dates. However, maturity of DES 04 and DES 24 grown on 15-inch rows was earlier at each harvest date.

Percentages of total seed cotton yields that were open at the first harvest on September 15 in 1976 (averages of both row spacings) were higher for all DES entries, and the differences were significant ($P < .05$) for DES 04, DES 18, and DES 32 (Table 3). These three and DES 24 were significantly earlier than Stoneville 213 at the second harvest on September 22. Maturity averaged over all "varieties" was earlier for the 15-inch row spacing at each harvest date.

Time to 80% open (1974-76 averages) was longer for Stoneville 213 on 40-inch rows than for any of the other treatments (Table 4). Except for DES 10 in 1974 and DES 32 in 1975, all DES "varieties" grown at each row spacing in 1974

Table 2. Influence of row spacing on earliness of six cotton "varieties", MAFES Delta Branch, 1975.

Variety	Row spacing	Dates of Hand Harvest[1]						
		9/8	9/17	9/23	10/1	10/9	10/16	10/28
	(inches)	--------------------% of Seed Cotton Open--------------------						
DES 04	40	30.8	47.7	59.2	69.0	78.1	86.7	91.3
	15	38.2	58.6	68.9	79.2	87.7	92.0	96.3
	Average	34.5a[2]	53.1a	64.1a	74.1a	82.9a	89.4a	93.8a
DES 18	40	42.8	58.2	68.1	75.7	82.7	88.0	91.4
	15	17.9	41.6	51.4	59.5	71.3	81.2	88.6
	Average	30.3ab	49.9ab	59.8ab	67.6ab	77.0ab	84.6ab	90.0ab
DES 56	40	35.6	51.2	60.5	71.7	80.2	86.9	91.0
	15	22.3	43.4	54.4	62.2	73.5	82.7	88.6
	Average	29.0ab	47.3ab	57.5abc	66.9ab	76.8ab	84.8ab	89.8ab
DES 32	40	32.4	47.8	58.2	66.4	72.6	80.0	83.6
	15	17.1	32.9	43.0	49.1	56.7	65.4	72.9
	Average	24.8bc	40.4b	50.6c	57.8c	64.6c	72.7c	78.3c
DES 24	40	22.7	38.7	49.6	59.6	70.7	78.5	85.1
	15	24.4	46.4	57.3	65.3	76.5	84.7	90.4
	Average	23.5bc	42.5b	53.4bc	62.4bc	73.6b	81.6b	87.7b
Stoneville 213	40	25.9	46.6	57.6	67.8	76.5	85.8	91.4
	15	14.7	36.9	50.1	60.3	70.0	79.3	87.9
	Average	20.3c	41.8b	53.9bc	64.1bc	73.2b	86.6ab	89.6ab
Row Spacing (inches)								
40 (Average all varieties)		31.7a	48.4	58.9	68.4a	76.8	84.3	89.0
15 (Average all varieties)		22.4b	43.3	54.2	62.6b	72.6	80.9	87.4

[1] A 10-foot section of row was harvested by hand on the dates listed.

[2] Means in the same column followed by the same letter do not differ significantly ($P < .05$) as determined by Duncan's new multiple range test.

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[4] *Cotton is less drought tolerant when grown in 15-inch rows, and it was dry in July and August of 1975.*

and 1975 were 80% open earlier than Stoneville 213 at the same row spacing. DES 04 grown on 15-inch rows was 80% open earlier than each other treatment each year.

Lint and cottonseed yields averaged over both row spacings for the three years were highest for DES 56, with lint yields significantly higher (P<.05) than for DES 04 and DES 32 and cottonseed yields significantly higher than for DES 32 and Stoneville 213 (Table 4).

Lint yields averaged over both row spacings were higher (P<.05) in 1974 for DES 56 than for Stoneville 213 and the other DES "varieties" except for DES 18. Differences in lint yields of the six "varieties" tested in 1975 were not significant. Lint production of all DES 24 plots averaged only 364 lbs/acre in 1976, significantly less than the average for all entries except DES 32.

Lint and cottonseed yields (averages of the five varieties tested each year) were higher o the 40-inch rows in 1974 and 1976 higher on the 15-inch rows in 1975 The 1974 lint yields of DES 04 an DES 32 were lower (P<.05) on th 15-inch rows than on the 40-inc rows.

Fiber property data were no analyzed statistically because see cotton from all replications of eac treatment was combined befor ginning. However, measures c fiber quality differed only slightl by row spacing (Table 5).

Table 3. Influence of row spacing on earliness of six cotton "varieties", MAFES Delta Branch, 1976.

Variety	Row spacing	Dates of Hand Harvest[1]			
		9/15	9/22	9/30	10/7
	(inches)	-----% of Seed Cotton Open-----			
DES 04	40	38.3	57.9	80.5	92.3
	15	78.6	89.6	95.9	99.9
	Average	58.5a[2]	73.7a	88.2	96.1
DES 18	40	47.9	68.7	88.4	96.7
	15	61.8	80.8	93.6	98.5
	Average	54.9ab	74.7a	91.0	97.6
DES 56	40	32.6	53.7	77.9	94.0
	15	60.0	77.3	93.9	97.6
	Average	46.3bc	65.5ab	85.9	95.8
DES 32	40	41.6	59.6	84.4	95.9
	15	67.0	79.9	90.9	98.4
	Average	54.3ab	69.8a	87.7	97.1
DES 24	40	39.4	63.3	84.6	94.3
	15	60.5	80.6	92.9	98.5
	Average	50.0abc	71.9a	88.7	96.4
Stoneville 213	40	29.9	46.9	72.1	85.9
	15	51.5	68.0	86.6	96.7
	Average	40.7c	57.4b	79.3	91.3
Row Spacing (inches)					
40 (Average all varieties)		38.3b	58.3b	81.3b	93.2b
15 (Average all varieties)		63.2a	79.4a	92.3a	98.2a

[1] A 10-foot section of row was harvested by hand on the dates listed.

[2] Means in the same column followed by the same letter do not differ significantly (P<.05) as determined by Duncan's new multiple range test.

Table 4. Influence of row spacing on earliness and yield of seven cotton "varieties", MAFES Delta Branch, 1974-76.

		Reached 80%				Lint				Cottonseed			
Variety	Row spacing	1974	1975	1976	1974-76 Average	1974	1975	1976	1974-76 Average	1974	1975	1976	1974-76 Average
	(inches)	----------No. Days[1]----------				----------Pounds per Acre----------							
DES 04	40	18.0	1.0	3.3	7.4	674cd[2]	774	474	640abc	1419	1731	885	1345a
	15	22.7	9.8	17.7	16.7	589f	825	378	597c	1261	1844	709	1271abc
	Average	20.4	5.4	10.5	12.1	632c	799	426ab	619b	1340ab	1788a	797	1308a
DES 18	40	16.0	5.5	7.5	9.7	734ab	852	448	678a	1430	1722	813	1322ab
	15	14.4	-3.7	11.7	7.5	706bc	815	407	643abc	1344	1707	761	1271abc
	Average	15.2	0.9	9.6	8.6	720ab	833	428ab	660a	1387a	1715ab	787	1296ab
DES 56	40	16.2	2.7	2.5	7.1	752a	798	466	672ab	1429	1695	852	1325a
	15	21.1	-2.4	10.3	9.7	761a	840	407	669ab	1386	1724	773	1294abc
	Average	18.7	0.2	6.4	8.4	756a	819	437ab	671a	1407a	1710ab	813	1310a
DES 32	40	15.9	-4.4	4.7	5.4	700bc	768	388	619bc	1402	1535	730	1222bc
	15	21.7	-27.5	11.1	1.8	638de	804	380	607c	1264	1651	707	1207c
	Average	18.8	-16.0	7.9	3.6	669bc	786	384bc	613b	1333ab	1593b	719	1214b
DES 10	40	-2.9				623ef				1208			
	15	3.6				624ef				1207			
	Average	0.4				623c				1208c			
DES 24	40		-7.2	5.1			806	376			1467	833	
	15		-0.4	11.0			817	353			1642	671	
	Average		-3.8	8.1			811	364c			1554b	696	
Stoneville 213	40	0.0	0.0	0.0	0.0	674cd	795	493	654abc	1275	1502	833	1204c
	15	8.5	-5.1	6.1	3.2	660cde	813	446	640abc	1236	1642	808	1229bc
	Average	4.3	-2.6	3.1	1.6	667bc	804	470a	647ab	1256bc	1572b	821	1216b
Average[3]	40	13.2	1.0	3.6	5.9	707c	797b	454e	653	1391c	1637b	823e	1284
	15	17.7	-5.8	11.4	7.8	671d	819a	404f	631	1298d	1714a	752f	1255
Average (year)[3]		15.5	-2.4	7.5	6.8	689b	808a	429c	642	1344b	1675a	787c	1269

[1] Number of days a particular variety and/or row spacing reached 80% open compared to Stoneville 213 in 40-inch rows. Positive sign denotes earlier, negative sign denotes later. Number of days not analyzed because replications were combined.

[2] Means in the same column or group followed by the same letter do not differ significantly ($P < .05$) as determine by Duncan's new multiple range test.

[3] Average of the five varieties included in each year of the three year test.

ble 5. Influence of row spacing on the fiber properties of seven cotton "varieties", MAFES
lta Branch, 1974-76.

		Composite Grade[1]				Staple Length				Strength[2]				Micronaire			
riety	Row Spacing	1974	1975	1976	1974-76 Average	1974	1975	1976	1974-76 Average	1974	1975	1976	1974-76 Average	1974	1975	1976	1974-76 Average
	(inches)	----------index----------				----------32nd inch----------				----------g/tex----------							
S 04	40	80	80	85	81.7	35	36	35	35.3	20.72	19.79	19.93	20.15	4.12	4.16	3.89	4.06
	15	80	80	76	78.7	35	34	34	34.3	20.72	20.28	17.97	19.66	4.20	4.22	3.44	3.95
S 18	40	80	89	94	87.7	35	35	34	34.7	19.68	19.19	17.52	18.80	4.61	4.73	4.21	4.52
	15	85	89	85	86.3	35	35	34	34.7	19.98	19.19	16.91	18.69	4.58	4.71	3.78	4.36
S 56	40	80	89	94	87.7	35	35	34	34.7	20.28	19.81	18.57	19.55	4.46	4.71	4.03	4.40
	15	94	89	85	89.3	35	34	34	34.3	19.83	19.66	19.03	19.51	4.42	4.65	3.70	4.26
S 32	40	85	89	90	88.0	35	35	34	34.7	19.54	19.19	18.12	18.95	4.01	4.43	3.75	4.06
	15	89	89	85	87.7	35	35	34	34.7	18.65	18.56	17.82	18.34	4.09	4.41	3.31	3.94
S 10	40	85				35				21.02				4.28			
	15	85				35				20.42				4.45			
S 24	40		85	85			35	34			20.59	20.84			4.49	3.92	
	15		85	85			35	34			20.44	19.63			4.68	3.58	
213	40	85	85	94	88.0	35	35	34	34.7	19.68	18.41	18.57	18.89	4.78	4.82	4.51	4.70
	15	80	85	85	83.3	35	35	34	34.7	19.39	19.19	18.27	18.95	4.78	4.89	4.40	4.69
rage[3]	40	82.0	86.4	91.4	86.6	35.0	35.2	34.2	34.8	19.98	19.28	18.54	19.27	4.40	4.57	4.08	4.35
	15	85.6	86.4	83.2	85.1	35.0	34.6	34.0	34.5	19.71	19.38	18.00	19.03	4.41	4.58	3.73	4.24
. (year)[3]		83.8	86.4	87.3	85.8	35.0	34.9	34.1	34.7	19.85	19.33	18.27	19.15	4.41	4.57	3.90	4.29

[1] Composite grade index for white cotton: Strict low middling = 94; Low middling = 85; and
ct good ordinary = 76. Cotton classed by USDA Classing Office, Greenwood, MS.

[2] Data given are the fiber strength of a bundle of fibers measured on the stelometer with the
s holding the fiber bundle separated by a 1/8-inch spacer, expressed in grams-force per tex.
is the linear density of fibers, filaments, and yarns expressed as the weight, in grams, of
0 meters of fiber or yarn.

[3] Average of the five varieties included in each year of the three year test.

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SOYBEAN
Response to Tillage of Sharkey Clay Soil

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Summary

Mack, Tracy and Bragg Soybeans were grown on a Sharkey clay in 40-, 30- and 20-inch rows for three years on plots subsoiled 18-20 inches deep with a curved-shank subsoiler, deep-chisel plowed 12 inches deep or shallow-chisel plowed 6 inches deep. A disk only treatment was compared with the other tillage methods in the third year. Data from the trials indicate that shallow tillage results in yields equal to those resulting from deep tillage and is, therefore preferable to deep tillage because o lower costs and reduced energ requirements.

Soybean Response to Tillage of Sharkey, Clay Soil

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Soybean Response to Tillage of Sharkey Clay Soil

Clay soils (Alligator, Dowling, Sharkey and unclassified) account for more than one half of the land area of the Yazoo-Mississippi Delta 7). Almost 10% of the soils are in the Sharkey series (montmorillonitic, Vertic Haplaquept), and 7.62% of the soils of the Delta of Mississippi are Sharkey clay. All clay soils are well suited for soybean production because of their high fertility and topographic position.

Sharkey clay has slow internal drainage and high water-holding capacity. Also, montmorillonitic clays predominate in the clay fraction and give the soil a high degree of shrink-swell potential upon drying and wetting (1). Soils that shrink and swell develop cracks or continuous pores of low root impedance or low soil strength (5,8), and roots growing in and through these natural cracks display a flattened appearance (13).

Deep tillage usually has increased crop yields only when water intake(and/or root penetration)has been limited by restrictive layers in the soil profile (4, 6, 8, 10, 11, 12). Soil strength usually is the factor that restricts root penetration through the pan formations (3, 8, 9, 10). Deep tillage reduces soil strength and root impedance in these zones. Time of tillage can affect yield response to the disruption of these soils (12) but may not increase yields if periods of drought stress are avoided by irrigation or adequate and timely rainfall, because plants are less dependent on moisture below the impervious layer (6,10).

Response to profile modification of soils with a high percentage of montmorillonitic clay has been varied. Cotton root penetration into the subsoil was altered only slightly by degree of compaction of a Mhoon clay loam (5). Severe mechanical disruption of the profile to 24 and 48 inches improved aeration and increased yields of cotton and grain sorghum on a deep, slowly permeable Houston black clay (2), but the tillage was so severe that many years of residual effect would be required for the procedure to return more than it costs.

This study was conducted to determine the effect of various types and depths of tillage and various row spacings on the yield of Mack, Tracy and Bragg soybeans grown on Sharkey clay soil.

Procedure

The three-year study was conducted on a Sharkey clay soil at the MAFES Delta Branch. Bulk density of the soil at all depths was well below the 1.6 g/cm³ (Table 1) reported by Zimmerman and Kardos (13) as the value at which soybean root penetration was severely restricted in a shrink-swell soil. All nutrient levels were high or very high at the beginning and at the end of the study.

Table 1. Properties of the Sharkey clay soil used in a study of the effects of various types and depths of tillage on the yield of soybeans, Stoneville, Mississippi.

Soil depth	Mineral fractions[1] Sand	Silt	Clay	Organic matter	Bulk density	pH	Nutrient analysis P	K	Mg	Ca
Inches	%				g/cm^3		lb/acre			
0.12	4	33	63	1.01	1.21	6.9	90	870	3170	13160
12.24	6	44	50	1.07	1.35	7.3	100	680	2645	11900
24-36	6	30	64	1.79	1.33	7.6	90	635	3570	13650
36-48	6	28	66	1.64	1.32	7.3	110	700	3925	13280

[1] Sand = > 0.05 mm diameter; silt = 0.002-0.05 mm diameter; clay = < 0.002 mm diameter.

1976 Trials

Plots were tilled on March 1 by (1) subsoiling 18-20 inches deep with a curved-shank subsoiler ("S") on 40-inch centers perpendicular to row direction, (2) by deep-chisel plowing ("DC") 12 inches deep on 20-inch centers perpendicular to row direction or (3) by shallow-chisel plowing ("SC") 6 inches deep on 20-inch centers perpendicular to row direction. Trifluralin was applied and disk incorporated on March 3.

The experiment was designed as a complete block with three replicates of treatments in a split-split plot arrangement. Tillage treatments were randomized within replicates, row spacings were randomized within tillage treatments, and varieties were randomized within row spacings. All tillage treatments were separated by 15-ft wide alleys.

Plots were planted May 21 with Mack, Tracy and Bragg soybeans at rates of 12 seed/row ft on 40-inch wide rows, nine seed/row ft on 30-inch wide rows and six seed/row ft on 20-inch wide rows. All rows were 30 ft long.

All plots were treated preemergence with a tank-mix of alachlor and linuron. The 40-inch wide rows were cultivated twice, and the 30- and 20-inch wide rows were hoed once by hand.

Moisture in the soil of each plot was measured throughout the growing season by neutron attenuation. All measurements were on dates preceded by seven or more days with no rainfall. One access tube was located in one dr row of each plot.

Plant height measurements an lodging scores were recorded f each plot, and all plants on 2.5 ft each end of each row were remov before harvesting Mack on Octob 4 and Tracy and Bragg o November 3. A combine modifi for use on small plots was used harvest two 40-inch wide rows three 30-inch wide rows and fo 20-inch wide rows from a replicates of each row spacing, an weights of harvested seed we converted to bu/acre at 1 moisture. Also, weights of two 10 seed samples per plot were recor ed.

1977 Trials

Tillage was delayed until May 10 because of wet soil. The test site used in 1976 (designated 1977A) and another site with a history of shallow tillage only (1977B) were prepared by the methods used in 1976. Trifluralin was applied and disk incorporated on April 13.

The experimental design of 1977A was the same as in 1976. The 1977B trial was replicated two times, and only the 40- and 20-inch row spacings were used.

All plots were planted on June 21, and the 40-inch wide rows we cultivated once. Mack wa harvested on October 18, Tra and Bragg on November 15.

All other procedures were th same as in 1976.

1978 Trials

The original test site was tilled on April 3. A disk-only ("D") treatment was added to the three tillage treatments used in the previous two years, and only 40- and 20-inch row spacings were used. The varieties and experimental design were the same as in 1976.

The 40-inch rows were cultivated twice, and the 20-inch rows were hoed once by hand. Mack wa harvested on October 11, Tracy a Bragg on October 30. All oth procedures were the same as 1976.

Results and Discussion

Rainfall from time of planting through October 1 measured 13.8, 10.0 and 15.2 inches in 1976, 1977 and 1978, respectively (Table 2). Eight of the 15.2 inches in 1978 were in the first two weeks after planting.

Depth of tillage did not alter soybean rooting depth significantly as determined by moisture content of the soil. Moisture content of the soil at each sample depth in 1976 was slightly higher in plots tilled with the curved-shank subsoiler than in plots tilled by the other methods (Table 3). The same relationship was found in 1977, but to a lesser extent, and was absent in 1978. Water was extracted from all measured depths of each tillage treatment in all years.

Yield differences among th three tillage treatments were n significant in any year, a differences in yields among th three row spacings were sign cant only in 1977, the year wh planting was delayed until June (Table 4). The inconsist differences in yield amo

Table 2. Average temperature, rainfall and pan evaporation in 1976, 1977 and 1978, by time periods, Stoneville, Mississippi.

Time period	1976				1977				1978			
	Average temp max	Average temp min	Rain-fall	Pan evap	Average temp max	Average temp min	Rain-fall	Pan evap	Average temp max	Average temp min	Rain-fall	Pan evap
	-----°F-----		----in.----		-----°F-----		----in.----		-----°F-----		----in.----	
May 1-15	75	54	1.77	3.09	84	62	0.43	4.33	75	57	9.84	3.34
May 16-31	78	58	1.50	3.39	91	66	0.63	5.33	87	66	2.05	3.78
June 1-15	86	66	0.83	4.09	93	68	1.10	5.09	85	66	6.77	3.45
June 16-30	86	68	5.16	3.29	92	74	1.34	4.57	94	74	0.20	4.49
July 1-15	88	69	3.15	3.58	94	73	2.91	4.53	96	75	0.75	4.70
July 16-31	93	71	0.47	4.34	91	72	0.79	3.29	93	72	0.04	4.84
Aug. 1-15	91	67	0.04	4.13	91	71	0.12	3.96	90	70	3.07	3.71
Aug. 16-31	92	67	0.24	3.94	91	71	0.75	3.69	92	70	1.54	4.08
Sept. 1-15	84	63	1.77	2.75	90	69	2.09	3.46	88	68	1.46	2.41
Sept. 16-30	84	61	1.06	2.53	86	66	2.80	2.63	85	65	0.55	2.52
Oct. 1-15	78	51	0.83	2.21	74	50	2.32	2.61	78	49	0.67	2.66
Oct. 16-31	63	42	2.99	1.56	76	49	0.59	2.14	77	46	0.24	2.61

Table 3. Volumetric soil water content of the Sharkey clay soil used in a study of the effects of various types and depths of tillage on the yield of soybeans, by sample depth, year and tillage method, Stoneville, Mississippi, 1976-1978.

Soil Depth	1976			1977			1978			
	S[1]	DC[2]	SC[3]	S[1]	DC[2]	SC[3]	S[1]	DC[2]	D[4]	SC[3]
	%/vol									
(in.)	Day 54[5] - July 14			Day 27 - July 18			Day 34 - June 27			
12	51.6	47.7	46.6	51.8	52.1	50.4	54.0	52.8	52.3	51.6
24	54.6	52.6	51.7	53.1	52.5	50.8	51.8	52.7	52.1	51.2
36	53.8	52.1	52.6	51.8	51.8	51.2	51.8	51.8	52.0	51.1
48	55.9	54.3	54.5	53.2	53.5	52.5	52.2	52.5	53.0	52.0
	Day 74 - August 3			Day 49 - August 9			Day 65 - July 28			
12	39.7	38.1	36.5	43.7	42.9	40.9	40.8	39.0	40.1	42.4
24	43.4	42.4	39.7	45.0	43.9	42.1	41.7	41.8	41.0	41.6
36	52.2	51.9	51.2	51.4	51.9	51.0	45.4	46.7	45.8	44.5
48	54.3	54.2	53.9	53.4	53.4	53.0	51.8	52.1	51.9	51.5
	Day 98 - August 27			Day 59 - August 19			Day 105 - Sept. 6			
12	34.0	30.1	29.1	40.8	39.9	36.6	40.4	39.2	41.4	42.2
24	39.5	37.1	35.6	41.7	40.3	37.8	42.1	39.8	41.5	41.5
36	42.2	41.8	39.9	47.8	47.2	46.6	44.1	42.7	43.3	43.2
48	51.7	52.1	47.2	52.4	52.8	52.0	48.5	49.1	48.0	49.6
	Day 117 - Sept. 15			Day 78 - Sept. 7			Day 121 - Sept. 22			
12	42.5	37.1	34.2	37.2	36.6	32.0	41.6	41.2	42.9	43.3
24	43.3	39.1	36.2	39.3	38.0	34.2	41.4	39.7	41.2	41.5
36	44.0	41.5	40.7	41.2	40.5	39.7	42.2	41.9	42.7	43.0
48	48.9	49.6	46.2	46.9	46.5	45.9	48.2	47.9	47.4	48.9

[1] S = Subsoiled 18 to 20 inches deep with a curved-shank subsoiler on 40-inch centers perpendicular to row direction

[2] DC = Deep-chisel plowed 12 inches deep on 20-inch centers perpendicular to row direction

[3] SC = Shallow-chisel plowed 6 inches deep on 20-inch centers perpendicular to row direction

[4] D = Disk only

[5] Day number = days after planting

varieties among years was attributed to timeliness of rainfall relative to the reproductive stages of the three varieties. Late planting and the low rainfall during the growing season appeared to be the major cause of the lower yields in 1977.

The only significant difference in seed weight among tillage treatments was in 1978 when the plots tilled by shallow-chisel plowing produced seed of lower weight. Some differences in seed weight among row spacings were significant, but the differences in seed weight did not appear to be related to the yield differences among row spacings.

Plant height did not differ significantly ($P<.05$) among tillage methods in 1976, 1977A and 1978 (Tables 5, 6 and 8). Narrowing the rows tended to cause shorter plants in 1977A and 1978 (Tables 6 and 8). Plant height in 1977B was affected ($P<.05$) by the interaction of tillage methods and row spacings (Table 7).

Height of Tracy and Bragg plants in 1976 was less ($P<.05$) on the 20-inch rows than on the 30- and 40-inch rows (Table 5). Differences in plant height in each trial followed the significant trend to taller plants with increased length of the growing season.

Lodging ratings are reported only for 1976 and 1977A (Table 9) when enough lodging occurred to make harvesting difficult.

Table 4. Seed yield and weight of 100 seed of soybeans grown on a Sharkey clay soil, by tillage method, row spacing, variety and year, Stoneville, Mississippi.

Item	Grain yield				Weight of 100 seed			
	1976	1977A[5]	1977B[6]	1978	1976	1977A[5]	1977B[6]	1978
	bu/acre				g			
Tillage								
S[1]	28.0 a[7]	22.8 a	22.5 a	28.2 a	14.1 a	14.9 a	14.7 a	14.4 a
DC[2]	28.5 a	22.9 a	22.3 a	28.5 a	14.2 a	14.8 a	14.9 a	14.2 a
SC[3]	27.8 a	23.0 a	21.7 a	28.2 a	14.2 a	14.8 a	14.7 a	13.7 b
D[4]	------	------	------	30.7 a	------	------	------	14.2 a
Row Spacing								
40 in.	28.2 a	21.8 b	21.2 b	29.2 a	14.0 c	14.8 a	15.0 a	14.3 a
30 in.	27.7 a	22.5 b	------	------	14.2 b	15.0 a	------	------
20 in.	29.0 a	24.4 a	23.1 a	28.6 a	14.6 a	14.7 a	14.5 b	14.0 b
Variety								
Mack	24.2 b	23.5 a	22.3 ab	29.0 a	11.6 c	13.3 c	13.3 c	14.0 b
Tracy	30.1 a	21.8 b	20.6 b	28.1 a	15.8 a	16.8 a	16.8 a	14.7 a
Bragg	30.6 a	23.3 a	23.6 a	29.5 a	15.3 b	14.4 b	14.2 b	13.7 b

[1,2,3,4] See Footnotes, Table 3.

[5] Same test area and experimental design as in 1976.

[6] Test conducted on a similar soil with a history of shallow tillage only.

[7] Values within each column for each item followed by the same letter did not differ ($P < .05$) according to Waller-Duncan k-ratio t-test (k-ratio = 100).

Table 5. Mature plant height of soybeans grown on a Sharkey clay soil by tillage method, row spacing and variety, Stoneville, Mississippi, 1976.

Item	Variety	Plant Height
		inches
Tillage		
S[1]		34.7a[4]
DC[2]		35.3a
SC[3]		34.6a
Row Spacing		
40 inches	Mack	32.0d[5]
	Tracy	34.8c
	Bragg	40.8a
30 inches	Mack	31.5d
	Tracy	34.2c
	Bragg	40.1a
20 inches	Mack	32.4d
	Tracy	32.8d
	Bragg	38.4b

[1,2,3] See footnotes, Table 3.

[4] Main effect means and [5] interaction means followed by the same letter did not differ (P<.05).

Table 6. Mature plant height of soybeans grown on a Sharkey clay soil, by tillage method, row spacing and variety, Stoneville, Mississippi, 1977A.[1]

Item	Plant Height
	inches
Tillage	
S[2]	35.5a[5]
DC[3]	37.0a
SC[4]	35.3a
Row Spacing	
40 inch	37.1a
30 inch	35.3a
20 inch	35.4a
Variety	
Mack	34.3b
Tracy	35.0b
Bragg	38.5a

[1] Same test site as used in 1976.

[2,3,4] See footnotes, Table 3.

[5] Means within each item followed by the same letter did not differ (P < .05).

Table 7. Mature plant height of soybeans grown on a Sharkey clay soil, by tillage method, row spacing and variety, Stoneville, Mississippi, 1977B.[1]

Item		Plant Height
		inches
Tillage	Row spacing	
S[2]	40 inches	28.3abc[5]
	20 inches	30.3a
DC[3]	40 inches	30.6a
	20 inches	27.8bc
SC[4]	40 inches	29.1ab
	20 inches	26.6c
Variety		
Mack		25.2c[6]
Tracy		28.3b
Bragg		32.9a

[1] Trial conducted on a Sharkey clay soil with a history of shallow tillage only.

[2,3,4] See footnotes, Table 3.

[5] Interaction means and [6] main effect means followed by the same letter did not differ (P < .05).

Table 8. Mature plant height of soybeans grown on a Sharkey clay soil, by tillage method, row spacing and variety, Stoneville, Mississippi, 1978.[1]

Item	Plant Height
	inches
Tillage	
S[2]	29.4a[6]
DC[3]	29.4a
SC[5]	28.5a
D[4]	30.1a
Row Spacing	
40 inch	30.8a
20 inch	27.9b
Variety	
Mack	20.7c
Tracy	32.0b
Bragg	35.3a

[1] Same test site as used in 1976 and 1977A.

[2,3,4,5] See footnotes, Table 3.

[6] Means within each item followed by the same letter did not differ (P < .05).

Table 9. Lodging scores of soybeans grown on a Sharkey clay soil, by tillage method, row spacing and variety, Stoneville, Mississippi, 1976 and 1977A.

Tillage	Row spacing	Lodging score[1] 1976	Lodging score[1] 1977A	Tillage	Variety	Lodging score 1976	Lodging score 1977A	Row spacing	Variety	Lodging score 1976	Lodging score 1977A
	(in.)	---- 1-5 ----				---- 1-5 ----		(in.)		---- 1-5 ----	
S[2]	20	3.4 a[5]	3.2 abc	S[2]	Mack	2.4 b	1.7 c	40	Mack	2.5 cd	2.8 d
	30	2.1 c	2.8 cd		Tracy	2.5 b	3.3 a		Tracy	3.9 a	3.8 a
	20	2.3 c	2.7 cd		Bragg	2.9 a	3.7 a		Bragg	4.0 a	3.8 a
DC[3]	40	3.2 a	3.6 a	DC[3]	Mack	2.2 b	2.6 b	30	Mack	2.1 d	1.8 e
	30	3.0 a	2.9 bc		Tracy	3.1 a	3.6 a		Tracy	3.1 b	3.3 bc
	20	2.4 bc	3.3 ab		Bragg	3.2 a	3.7 a		Bragg	3.2 b	3.4 abc
SC[4]	40	3.4 a	3.6 a	SC[4]	Mack	2.2 b	1.9 c	20	Mack	2.4 cd	1.7 e
	30	2.9 ab	2.8 cd		Tracy	3.2 a	3.3 a		Tracy	2.7 c	3.0 cd
	20	2.4 bc	2.4 d		Bragg	3.2 a	3.5 a		Bragg	3.2 b	3.7 ab

[1] 1 = almost all plants erect; 2 = all plant leaning slightly, or some plants down; 3 = all plants leaning moderately, or 25 to 50% of plants down; 4 = all plants leaning considerably, or 50 to 80% of plants down; 5 = all plants down.

[2,3,4] See footnotes, Table 3.

[5] Means in each column followed by the same letter did not differ ($P < .05$).

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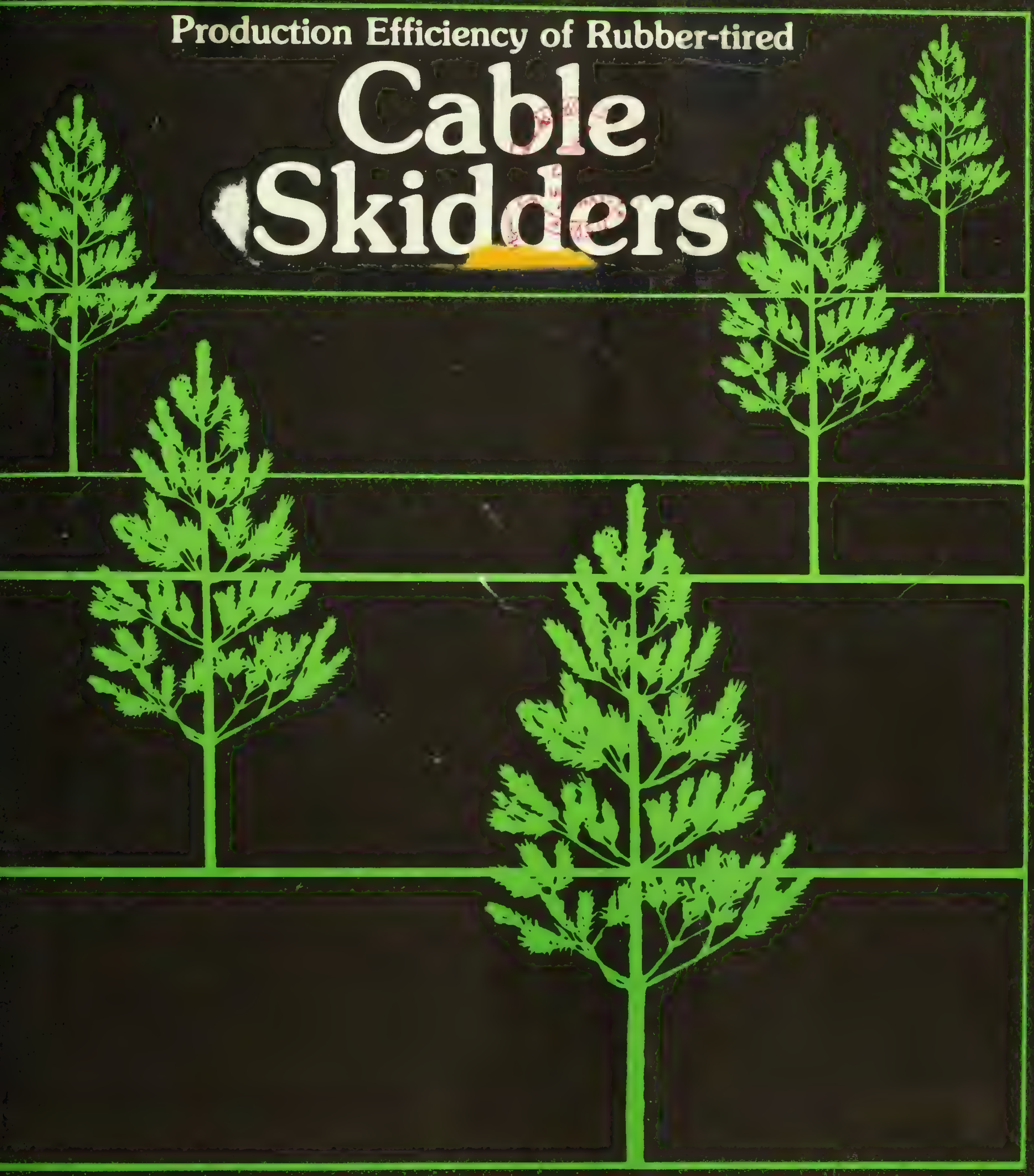
Production Efficiency of Rubber-tired Cable Skidders



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Production Efficiency of Rubber-tired Cable Skidders

Skidding is a major determinant of the volume harvested and is the highest-cost component of mechanized timber harvesting in the South. The efficiency of timber-harvesting operations is reduced significantly if too many long skidder hauls are made (Kroger, 1976; Walbridge, 1960 and Jiles and Lehman, 1960), and/or if underpowered and overpowered skidders are used (Kroger, 1976). The effect of two or more skidders on the efficiency of an operation has not been reported, but it is known that the use of two or more of them at the same site requires more time for reconnaissance and planning of each load.

This study was initiated with the objective of developing information needed for increasing the efficiency of skidders used in timber-harvesting operations in Mississippi. Attainment of the objective required explanation of (1) the variation in numbers of stems skidded (stems per hour per skidder) in typical harvesting operations and (2) the reasons for these variations.

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Procedure

Time study crews visited typical non-industrial timber-harvesting operations on 53 days in the spring and summer of 1976 and made 111 observations for periods of at least 30 minutes each. Data recorded included (1) the number of skidders in each operation; (2) flywheel horsepower of the skidders; (3) average skid distance; (4) numbers of stems skidded; (5) average volume of stems skidded; (6) time spent in the skidding operation, including locating logs to be skidded, in-woods positioning of logs for hook-up, hooking and unhooking chokers and travel time of skidders to and from the loading area; (7) time spent in other activities, such as lubricating and refueling equipment, pulling preventive maintenance and rest breaks; (8) tree sizes and stand conditons in the areas where skidders were operating and in similar areas where trees had not been felled; (9) slopes of skidding areas relative to loading areas and (10) drainage of the skidding areas.

Numbers of trees skidded per productive hour were regressed against each characteristic of the skidding operations and of the stands, and multiple regression was used to develop an equation that gave the best estimate of numbers of trees skidded per productive hour.

Estimates of the numbers of trees skidded per hour were multiplied by the average cubic foot-volume of stems to get the volume skidded per hour, and the cubic foot volume was divided by 80 to get the number of cords per productive hour. Skidder production per week then was determined by multiplying cords per productive hour by 28.5.[1]

Results

The equation that best explained the variation in skidder production accounted for 64% of the total variation and was as follows:

$$\hat{X} = 31.6 - 2.03\,Y_1 + 0.155\,Y_2 - 1.43\,Y_3 + 0.00116\,Y_4 - 0.461\,Y_5 + 0.0028\,Y_6$$

where

$\hat{X}$ = estimated number of trees per hour

Y_1 = number of skidders per operation

Y_2 = flywheel horsepower of skidder

Y_3 = average skid distance in 100 ft.

Y_4 = cube of average skid distance

Y_5 = average cubic-foot volume of stems

Y_6 = square of average cubic-foot volume of stems

(standard error = 5.4)

Estimated production per skidder per week ranged from 27 cords for operations using four 75-horsepower skidders to skid 40-cubic foot stems an average distance of 2000 feet to 457 cords for using one 125-horsepower skidder to skid 40-cubic foot stems an average distance of 200 feet (Tables 1, 2, and 3). Production by skidders of each horsepower decreased with each increase in the number used in an operation.

---

[1] *Skidders in the observed operations were used in production activities an average of 71.2% of the time (28.5 hrs/40-hr work week).*

Table 1. Estimated weekly productivity per skidder of 75-horsepower skidders used in productive activity for 28.5 hrs./week, by number of skidders, cubic foot volume of stems skidded and average skidding distance.

NUMBER SKIDDERS IN THE OPERATION	STEM VOLUME	AVERAGE SKIDDING DISTANCE (feet)									
		200	400	600	800	1000	1200	1400	1600	1800	2000
	cubic feet	cords per week									
1	10	121	111	102	93	85	77	71	67	64	63
	15	171	156	142	129	116	106	97	90	85	84
	20	215	195	176	158	142	128	116	107	101	99
	25	254	229	206	183	163	145	130	119	111	108
	30	289	259	230	203	179	158	140	126	117	114
	35	319	285	251	220	192	167	146	130	119	115
	40	347	307	269	234	201	172	149	130	118	114
2	10	114	104	94	85	77	70	64	60	57	55
	15	160	145	131	118	106	95	86	79	75	73
	20	201	181	162	144	128	113	102	92	86	84
	25	236	211	187	165	145	127	112	101	93	90
	30	267	237	209	182	157	136	118	104	95	92
	35	294	259	226	195	166	141	120	104	94	90
	40	318	279	240	205	172	143	120	101	90	85
3	10	107	97	87	78	70	63	57	52	49	48
	15	149	135	120	107	95	84	75	68	64	62
	20	186	166	147	130	113	99	87	78	72	70
	25	218	193	169	147	127	109	94	83	75	72
	30	245	215	187	160	136	114	96	83	74	70
	35	269	234	201	169	141	116	95	79	69	64
	40	289	250	212	176	143	114	91	73	61	56
4	10	99	89	80	71	63	56	50	45	42	41
	15	139	124	109	96	84	73	64	57	53	51
	20	172	153	133	115	99	85	.73	64	58	55
	25	200	175	151	129	109	91	76	64	57	54
	30	224	194	165	138	114	93	75	61	52	48
	35	243	209	175	144	116	91	70	54	43	39
	40	260	221	183	147	114	86	62	44	32	27

Interpretation of Results

The productivity estimates presented in the tables need to be adjusted for operations where skidders are used in productive activity for more or less than 28.5 hrs/week, and for operations where site conditions differ from those observed in this study. Almost all operations were skidding on flat ground or up gentle slopes to a loading area at the top of a hill, and they all minimized production decreases in rainy periods by moving to well-drained reserve areas.

The one variable that cannot be attained easily is average skid distance, because it increases with each increase in size of tracts of a given configuration and differs for different configurations of tracts of a given size and by location of the loading deck (Figure 1). Examples[2] are as follows:

40-acre circular tract
744.7 ft = R (radius)
496.5 ft = L (Average straight-line distance to trees = R)
923.4 ft = S (average skid distance = 1.24 R)

47-acre circular tract
807.3 ft = R
538.1 ft = L
1001.0 ft = S

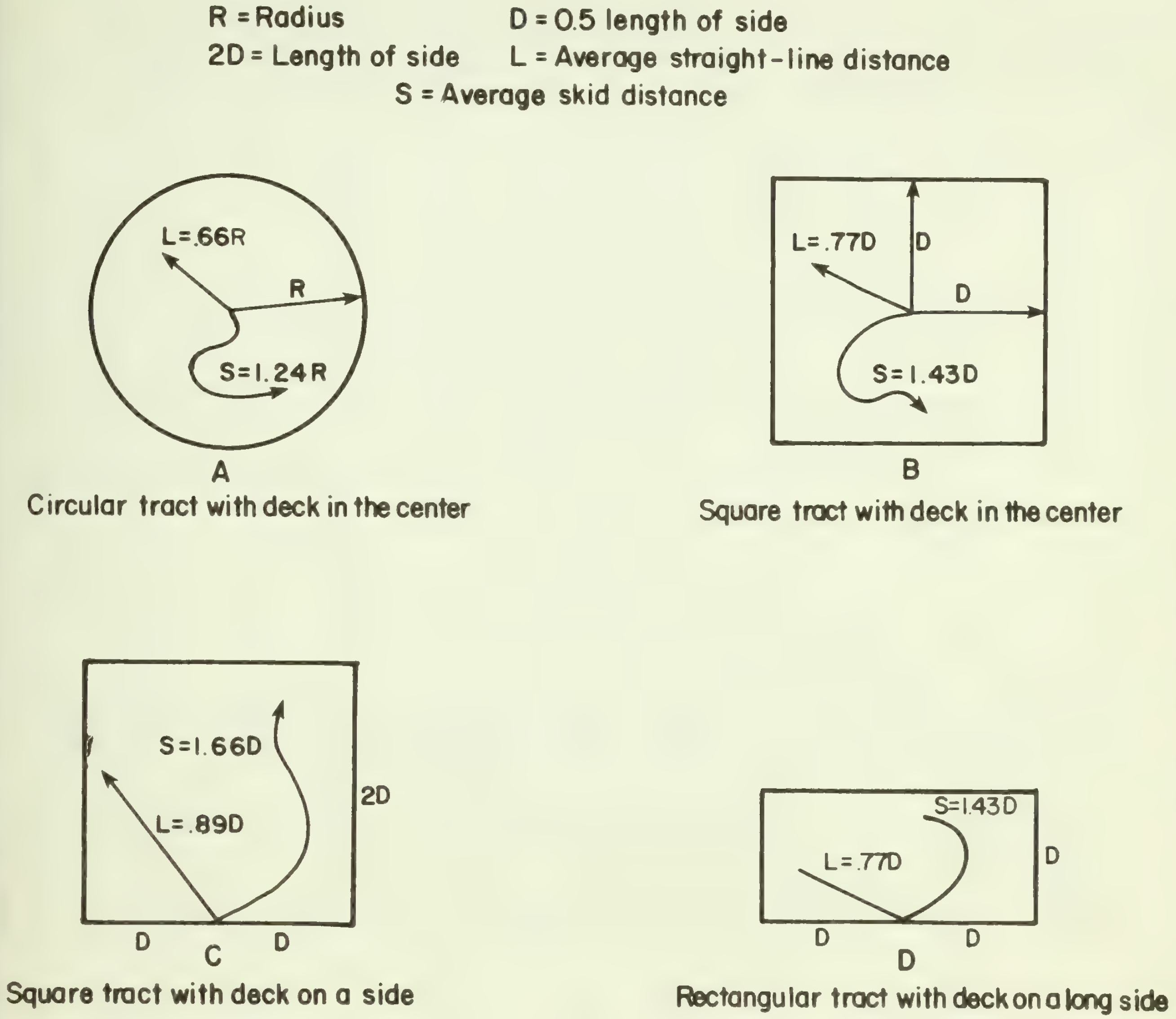
40-acre square tract with loadi
deck in the center
1320.0 ft = 2 D (length of ea
side of tract)
660.0 ft = D
508.2 ft = L (average straig
line distance to trees = 0.77
943.8 ft = S (average ski
distance = 1.43 D)

40-acre square tract with loadi
deck on one side
1320.0 ft = 2 D
660.0 ft = D
587.4 ft = (average straig
line skid distance to trees
0.89 D)*
1095.6 ft = (average skid
tance = 1.66 D)*

---

[2] *Examples are based on Figure 1 which shows average straight-line distances and estimates of average skid differences derived from an equation by Kroger (1976) for stands with uniform distribution of trees.*

**Note that straight-line skid distance and average skid distance for a 20-acre rectangular tract with deck on one long side are the same as for a 40-acre tract with deck in the center (Figure 1 D)*



R = Radius
D = 0.5 length of side
2D = Length of side
L = Average straight-line distance
S = Average skid distance
L=.66R
R
S=1.24R
A
Circular tract with deck in the center
L=.77D
D
D
S=1.43D
B
Square tract with deck in the center
S=1.66D
L=.89D
2D
D
C
D
Square tract with deck on a side
S=1.43D
L=.77D
D
D
D
D
Rectangular tract with deck on a long side

Figure 1. Guidelines for estimating average skid distance on circular tracts, on square tracts with loading deck in the center or on one side of the tract and on rectangular tracts with loading deck on one long side of the tract.
(Derived from an equation by Kroger, 1976 for stands with uniform distribution of trees.)

Examples for keying average kid distances to expected volume roduced/skidder per week are as ollow:

Assume a 47-acre circular tract with average volume of 20 cubic feet per stem. Expected production of two 75-horsepower skidders is 128 cords/skidder/week (line 10 under 1000-ft average skidding distance, Table 1). Expected production of two 100-horsepower or two 125-horsepower skidders is 155 and 183 cords/skidders/week, respectively (Table 2-3).

Table 2. Estimated weekly productivity per skidder of 100-horsepower skidders used in productive activity for 28.5 hrs./week, by number of skidders, cubic foot volume of stems skidded and average skidding distance.

NUMBER SKIDDERS IN THE OPERATION	STEM VOLUME	AVERAGE SKIDDING DISTANCE (feet)									
		200	400	600	800	1000	1200	1400	1600	1800	2000
	cubic feet	cords per week									
1	10	135	125	115	106	98	91	85	81	78	76
	15	192	177	163	149	137	126	117	110	106	104
	20	243	223	204	186	170	155	144	134	128	126
	25	289	264	240	218	197	179	165	153	146	143
	30	330	300	272	245	220	199	181	167	158	155
	35	368	333	299	268	240	215	194	178	167	163
	40	402	363	324	289	256	228	204	185	174	169
2	10	128	118	108	99	91	84	78	73	70	69
	15	181	166	152	138	126	115	106	100	95	93
	20	228	208	189	172	155	141	129	120	114	112
	25	271	246	222	200	179	161	146	135	128	125
	30	308	278	250	223	199	177	155	146	137	133
	35	342	308	274	243	214	189	169	153	142	138
	40	373	334	296	260	227	199	175	157	145	140
3	10	120	110	101	92	84	77	71	66	63	62
	15	170	155	141	128	115	105	96	89	84	83
	20	214	194	175	157	141	127	115	105	100	97
	25	252	228	204	181	161	143	128	117	110	107
	30	287	257	228	201	171	156	138	124	115	111
	35	317	282	249	218	189	164	143	127	117	113
	40	344	305	267	231	198	170	146	128	116	111
4	10	113	103	94	85	77	69	63	59	56	55
	15	159	144	130	117	104	94	85	78	73	72
	20	199	180	161	143	126	112	100	91	85	83
	25	234	210	186	163	143	125	110	99	91	88
	30	265	235	207	180	155	134	116	102	93	90
	35	292	257	224	192	164	139	118	102	92	87
	40	315	276	238	202	169	141	117	99	87	82

Table 3. Estimated weekly productivity per skidder of 125-horsepower skidders used in productive activity for 28.5 hrs./week, by number skidders, cubic foot volume of stems skidded and average skidding distance.

NUMBER SKIDDERS IN THE OPERATION	STEM VOLUME	AVERAGE SKIDDING DISTANCE (feet)									
		200	400	600	800	1000	1200	1400	1600	1800	2000
	cubic feet	cords per week									
1	10	149	139	129	120	112	105	99	94	91	90
	15	212	198	183	170	158	147	138	131	127	125
	20	270	250	231	214	197	183	171	162	156	154
	25	323	298	274	252	232	214	199	188	180	177
	30	371	341	313	286	262	240	222	209	200	196
	35	416	381	348	316	288	263	242	226	216	211
	40	457	418	379	344	311	283	259	241	229	224
2	10	141	131	122	113	105	98	92	87	84	83
	15	202	187	172	159	147	136	127	120	116	114
	20	256	236	217	199	183	169	157	147	142	139
	25	305	280	256	234	214	196	181	169	162	159
	30	350	320	291	264	240	219	201	187	178	174
	35	390	356	322	291	263	238	217	201	190	186
	40	428	389	351	315	282	254	230	212	200	195
3	10	134	124	115	106	98	90	84	80	77	76
	15	191	176	162	148	136	125	116	109	105	103
	20	241	222	202	185	168	154	142	133	127	125
	25	287	262	238	216	196	178	163	151	144	141
	30	328	298	269	243	218	197	179	165	156	153
	35	365	330	297	266	237	212	191	175	165	161
	40	399	360	322	286	253	225	201	183	171	166
4	10	127	117	107	98	90	83	77	73	70	69
	15	180	165	151	137	125	114	105	99	94	92
	20	227	207	188	170	154	140	128	119	113	110
	25	269	244	220	198	177	160	145	133	126	123
	30	206	276	248	221	197	175	157	144	135	131
	35	340	305	272	240	212	187	166	150	140	136
	40	371	331	293	257	224	196	172	154	142	137

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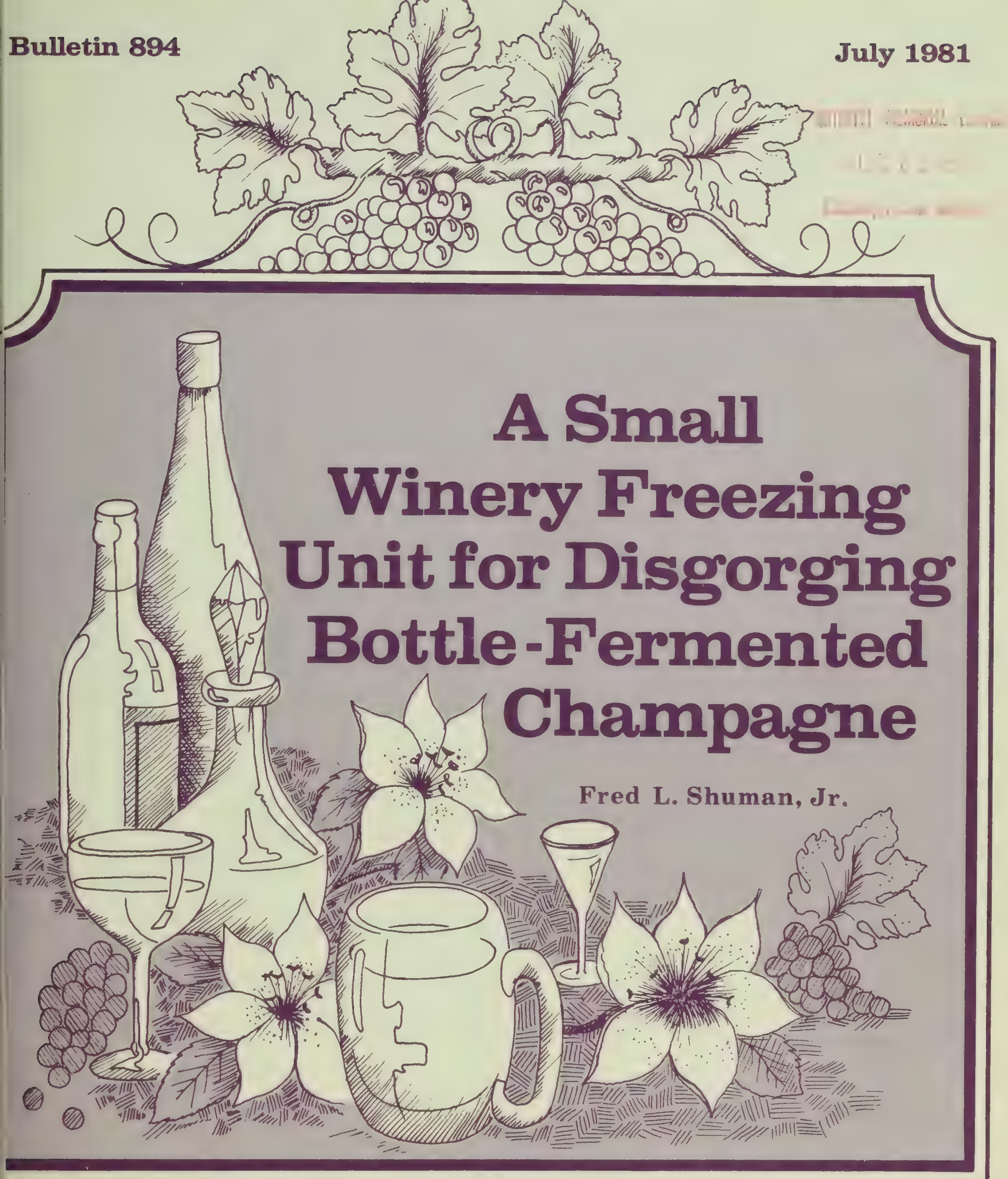
Bulletin 894

July 1981



A Small Winery Freezing Unit for Disgorging Bottle-Fermented Champagne

Fred L. Shuman, Jr.

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A Small Winery Freezing Unit for Disgorging Bottle-Fermented Champagne

Fred L. Shuman, Jr., agricultural engineer, MAFES/Mississippi State University Department of Agricultural and Biological Engineering, and processing engineer, A. B. McKay Food and Enology Laboratory, MAFES

Summary and Conclusion

A small frozen food display case was purchased for about $325 and was modified for use in freezing the sediment in champagne bottles for disgorging. The unit performed extremely well and permitted disgorging at a rate of 20 bottles an hour by one individual who performed all operations in freezing, disgorging, refilling, corking and attaching the wire hood to the bottles. Cost of operation was negligible.

The only negative aspect of the operation was the slow evaporation of alcohol from the water/alcohol solution. Small quantities of alcohol had to be added after extended use to mai tain the solution at 35% alcohol (volume) to prevent freezing of t solution. This was not found to b serious problem.

We conclude from our experien with this unit that it is ve suitable for disgorging champag in small wineries.

A Small Winery Freezing Unit for Disgorging Bottle-Fermented Champagne

Champagne produced by the aditional method (in-bottle rmentation or "methode ampenois") is made by starting ith the appropriate wine, adding precise amount of sugar and a ampagne strain of yeast (and casionally other materials), ttling, capping (usually with a own cap) and storing in a rizontal position to undergo rmentation. Carbon dioxide gas produced during the fermenta- on process, but is not allowed to cape; therefore, considerable essure is developed in the bottles. fter sufficient time has passed to low complete fermentation and e development of the champagne uquet, the champagne must ndergo a clarification process in hich the dead yeast cells and diment are removed. This is complished by placing the ttles upside down (either vertical slightly inclined from vertical) racks, periodically rotating them nd dropping them back into the cks (riddling) to dislodge the diment from the sides of the ttle and cause the sediment to be posited by gravity on the cap. his step is followed by a disgorg- g process which is accomplished y freezing the deposited material the neck of the still-inverted ottle, turning the bottle upright to n angle of about 45°, quickly moving the crown cap and allow- g the internal bottle pressure to low out the plug of frozen sedi- ent. The bottle is then refilled ith sufficient syrup, champagne c. to replace the amount lost in e disgorging process. It is then rked and the wire hood is at- ched to hold the cork in place gainst internal pressure (2).

Large producers of champagne use high capacity equipment which is too large and too expensive for small producers. Small wineries sometimes resort to relatively crude, slow methods (such as placing the bottles in various ice/salt solutions) and processing a few bottles at a time. Mississippi wineries and other relatively low volume producers need small-scale equipment designed especially for their unique requirements. This publication presents information on a small, efficient and economical device designed and developed for freezing the necks of champagne bottles before disgorging. The design is for a unit that satisfies the present needs of the Enology Laboratory at Mississippi State University; however, it also will satisfy the requirements of many small wineries and can be scaled up or down to provide larger or smaller capacities as needed by the individual winery. The factors of primary importance in this design involved the need to satisfy the following requirements:[1] the unit should be relatively inexpensive, of sufficient capacity for use in a small winery, simple to operate, economical to use, readily available, portable and conventional so that service and repairs can be made by available technicians.

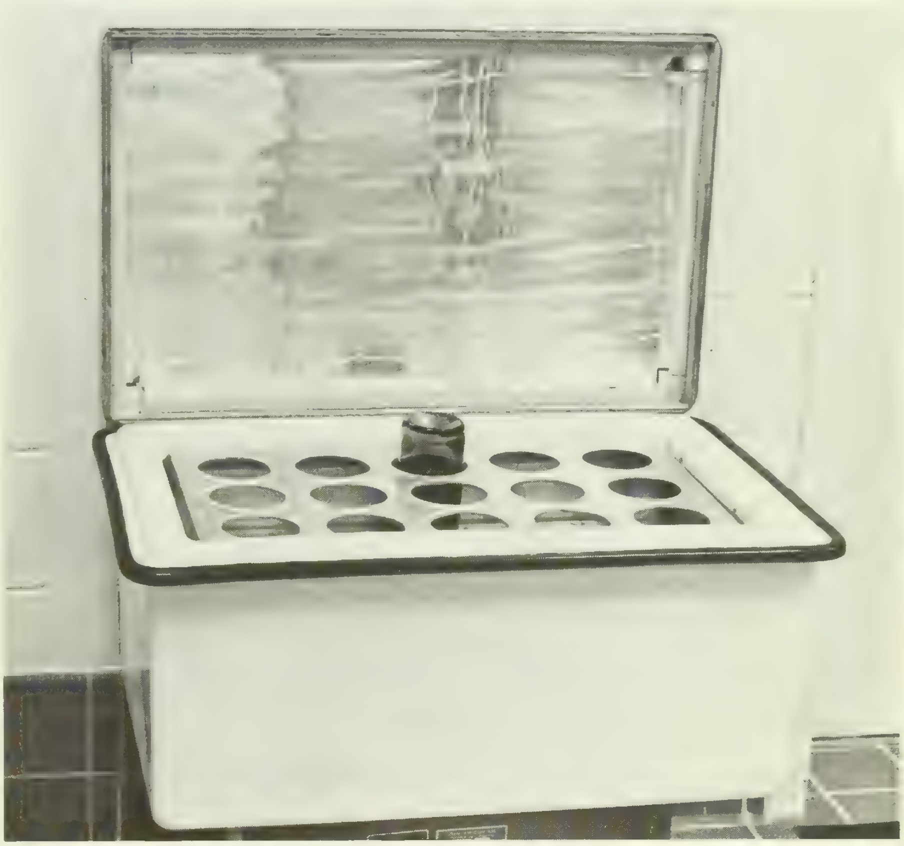

Fig. 1. Freezing unit with top open and bottle rack installed.

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[1] Appreciation is acknowledged to Dr. B. J. Stojanovic, enologist and head, A. B. McKay Food and Enology aboratory, for his suggestions regarding requirements for small-scale production and processing of ampagne.

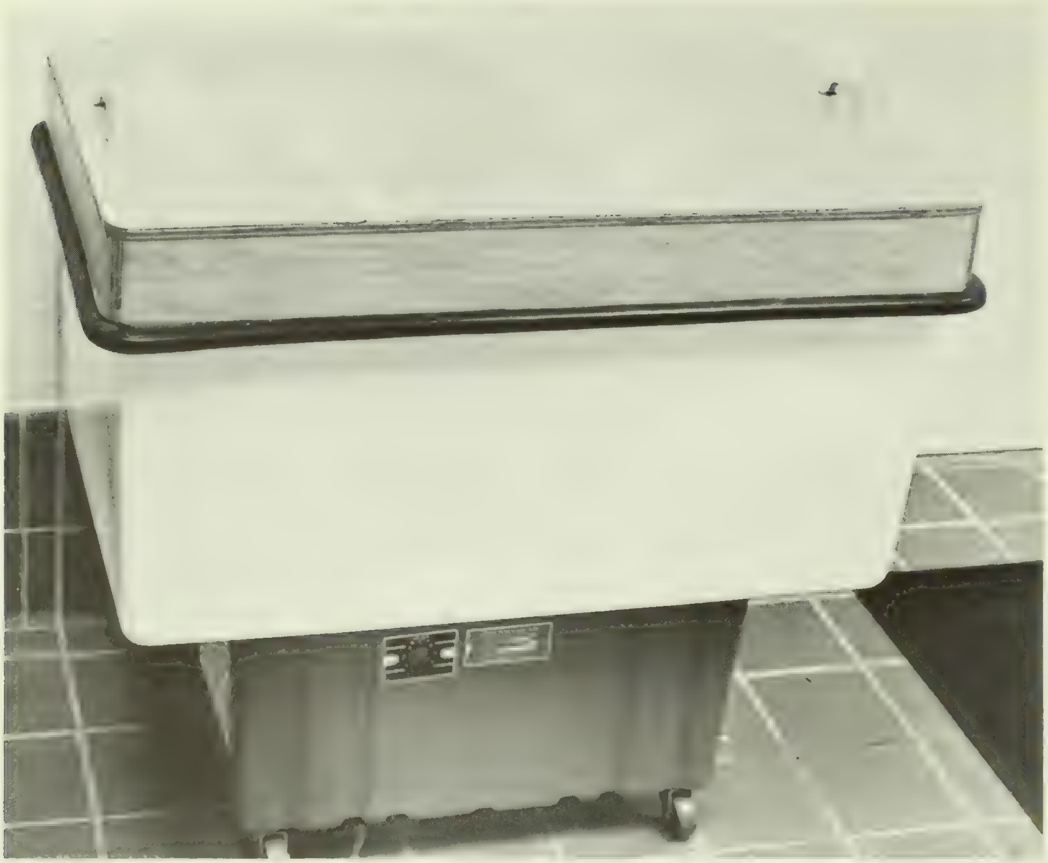


Fig. 2. Freezing unit with insulated cover closed.

System Components

The basic unit (Figures 1 and 2) is a small open chest type frozen food display case (Artic Star,® Model PL-3, manufactured by the Artic Star Mfg. Co., 3540 West Pioneer Pkw., Arlington, TX 76013) which was modified by the addition of a bottle rack (Figures 1 and 3) and an insulated cover (Figures 1, 2 and 4) and by sealing the freezer compartment to hold a cooling solution. The unit has a 1/5 horsepower refrigeration system that operates on 115 volt, 60 Hz alternating current and has variable temperature control. It has a freezing compartment about 27 inches (68 cm) long by 15 1/4 inches (39 cm) wide by 11 inches (28 cm) deep with overall dimensions of 34 inches (86 cm) long by 22 inches (56 cm) wide by 28 inches (71 cm) high.

The box originally was designed for holding and displaying solid materials and had open seams, rivets, etc., and it was necessary to seal all potential leaks so that it would retain the cooling solution. The leaks were sealed with clear Dow Corning® silicone rubber sealer.

The rack shown in Figures 1 and 3 was fabricated from 0.040-inch (1 mm) stainless steel sheet pop-riveted to an aluminum angle framework. It was designed to hold fifteen 750 ml champagne bottles in an inverted position. It would be more desirable to use stainless steel throughout; however, the aluminum frame was used in th case because it was immediatel available. The rack also could b made of wood, plastic, wire or oth materials, depending upon the availability and the skills of th fabricator.

The plywood cover (Figures 1, and 4), which was insulated wit Celotex® Thermo-Bord (a polyisocyanurate), was added t improve the efficiency of the oper tion by reducing the cooling loss from the unit. The cover was kept i place during precooling of th freezing solution as well as durin the disgorging process and remo ed only to remove bottles or insert bottles into the rack.

Operating Procedure

The general steps in the procedure used in these experiments were the following:

1. The inverted bottles of champagne were chilled for 24 to 48 hours at about 25°F (-4°C).
2. The freezer unit containing the bottle rack and freezing solution was precooled overnight in preparation for use the following day.
3. The chilled bottles of champagne were placed in the rack and left long enough for the sediment to freeze in the necks.
4. The first bottle with the frozen plug of sediment was removed from the rack for disgorging after about ten minutes and was replaced at the same time by another bottle of chilled champagne from the cold stablilization chamber.
5. This process was continued until all 15 bottles in the rack had been disgorged. The neck of the first replacement bottle was frozen by this time, and the process of removal and replacement of bottles was continued.

The following discussion presents the procedural steps in greater detail.

The champagne was first cooled to about 25°F (-4°C) to reduce the internal pressure and reduce losses during disgorging. This precooling was done in the Laboratory cold stabilization chambers but also could be accomplished in a household or industrial freezer or refrigerator with appropriate temperature controls. Some producers precool the champagne only to around 45°F (7.2°C) (1); however, the colder the champagne (within limits) the lower the pressure and the more easily the sediment is frozen.

The freezer unit was filled with the cooling solution to a depth that would reach about one inch (2.5 cm) up on the neck of the inverted bottles suspended in the rack. The actual depth of the solution used in this case was about 2.75 inches (7 cm).

Various anti-freeze solutions were tested to determine their suitability for this application. The solution that appeared to function most effectively was a mixture of 65% water and 35% ethyl alcohol of about 70 proof. The alcohol slowly evaporated and had to be replenished occasionally. The solution was checked periodically with a Proof and Tralle's hydrometer to determine when more alcohol should be added.

The empty rack was placed in the unit before precooling because frost build-up on the interior of the unit sometimes prevented insertion of the rack after precooling.

Precooling overnight was required to reduce the temperature of the freezing solution to 5°F (-15°C) with the small capacity refrigeration unit. This unit was selected for its ability to maintain the proper temperature during the freezing/disgorging operation. The low initial cost and low cost of operation justify the use of the small-capacity unit rather than a large-capacity refrigeration unit with quick-freezing capability but higher initial and operating costs.

Chilled bottles of champagne were transferred from the cold chamber to the rack in the cooling unit with a minimum of agitation. It is recommended that bottles be handled gently and deposited carefully in the rack during this transfer process. The freezing solution contained slushy ice during the disgorging operation, but this is a normal condition and will create no problems. However, it is not recommended that bottles be left in the unit (with the freezer in operation) overnight, as the solution may freeze solid, trapping the bottles in the ice.

About ten minutes were required to freeze the sediment in the necks of the first 15 precooled bottles placed in the rack. A new bottle of chilled champagne was inserted in the place of each bottle removed for disgorging. The neck of the first replacement bottle was frozen by the time the first 15 bottles were removed. The temperature of the freezing solution and the time of cooling were selected to allow withdrawal of bottles and continuous insertion of new bottles ready for disgorging. This timing permitted continuous disgorging for any desired length of time.

The output rate was about twenty 750 ml bottles per hour with only one individual performing all operations of freezing, disgorging and refilling, corking and attaching the wire hood.

Cost of operating the unit was about two cents per hour (based on 4.5 cents per kilowatthour for electrical power).

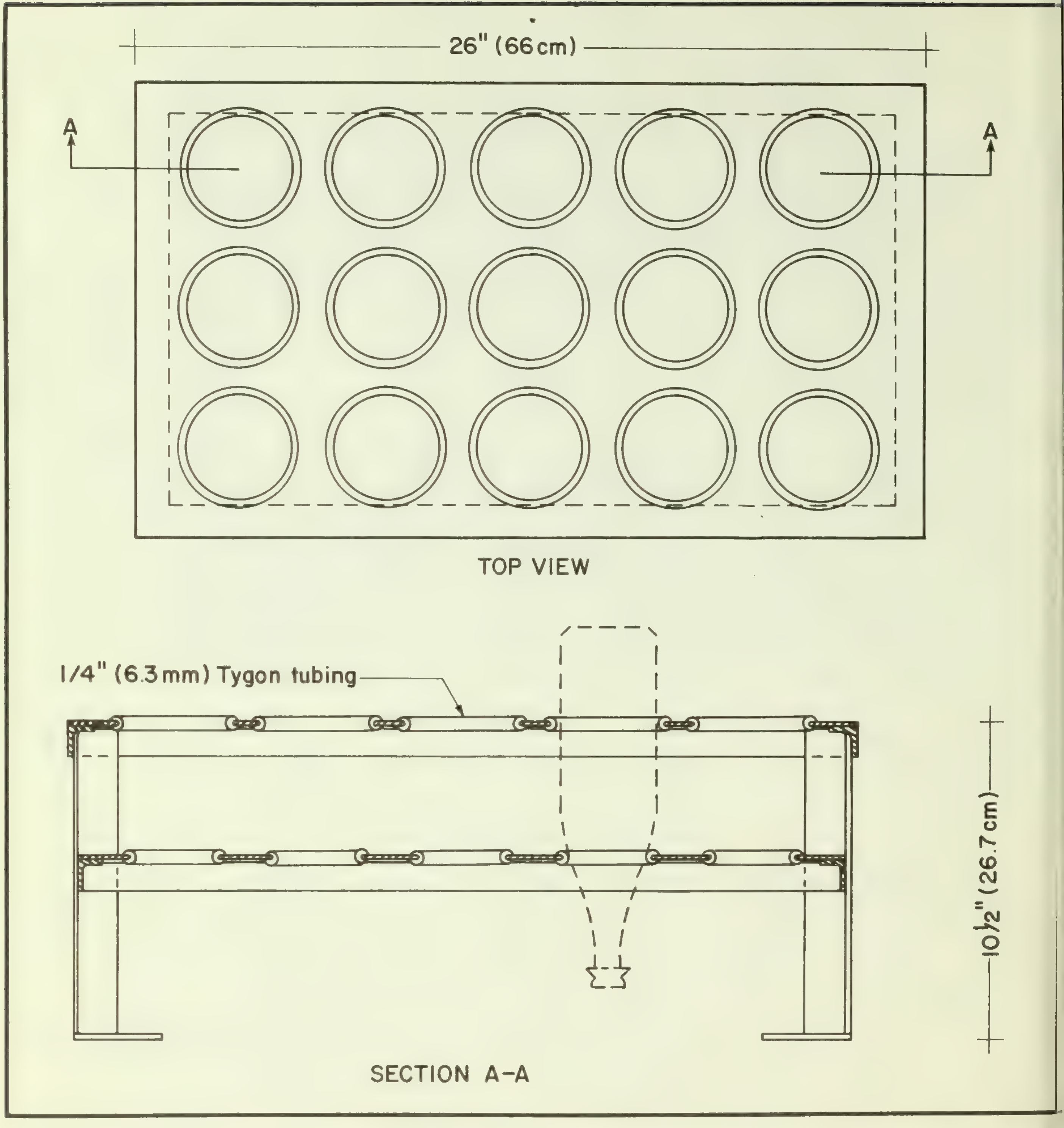
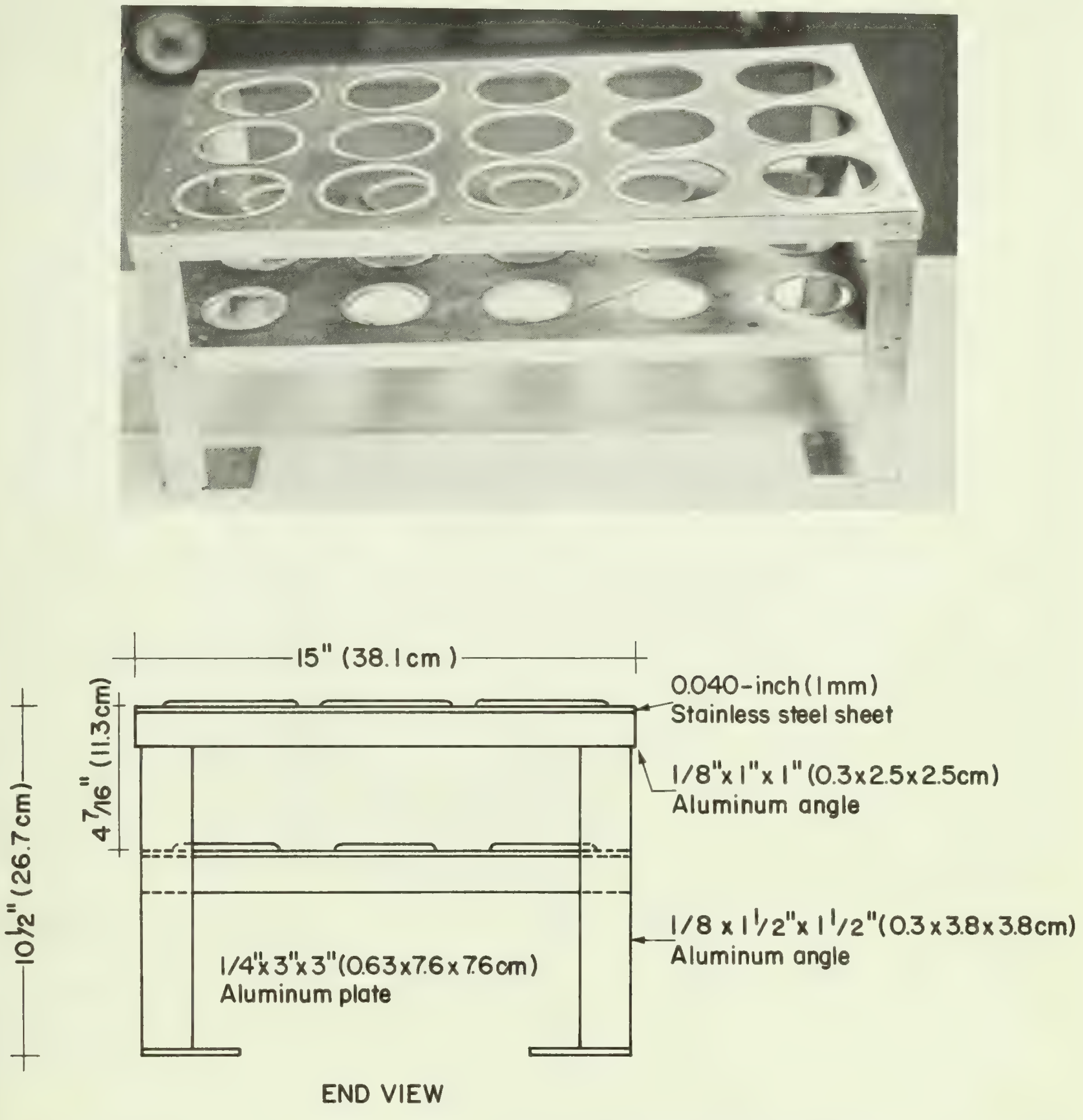

26" (66 cm)
A
A
TOP VIEW
1/4" (6.3 mm) Tygon tubing
10½" (26.7 cm)
SECTION A-A

FIGURE 3. CONSTRUCTION DRAWINGS AN

NOTE : Holes in top plate bored 3 7/8" (9.8 cm) and lined with Tygon tubing.
Holes in bottom plate bored 2 3/4" (7 cm) and lined with Tygon tubing.


15" (38.1 cm)
0.040-inch (1 mm)
Stainless steel sheet
1/8"x 1"x 1" (0.3x2.5x2.5cm)
Aluminum angle
1/8 x 1 1/2"x 1 1/2" (0.3x3.8x3.8cm)
Aluminum angle
1/4"x 3"x 3" (0.63x7.6x7.6cm)
Aluminum plate
4 7/16" (11.3cm)
10 1/2" (26.7cm)
END VIEW

HOTOGRAPH OF BOTTLE RACK

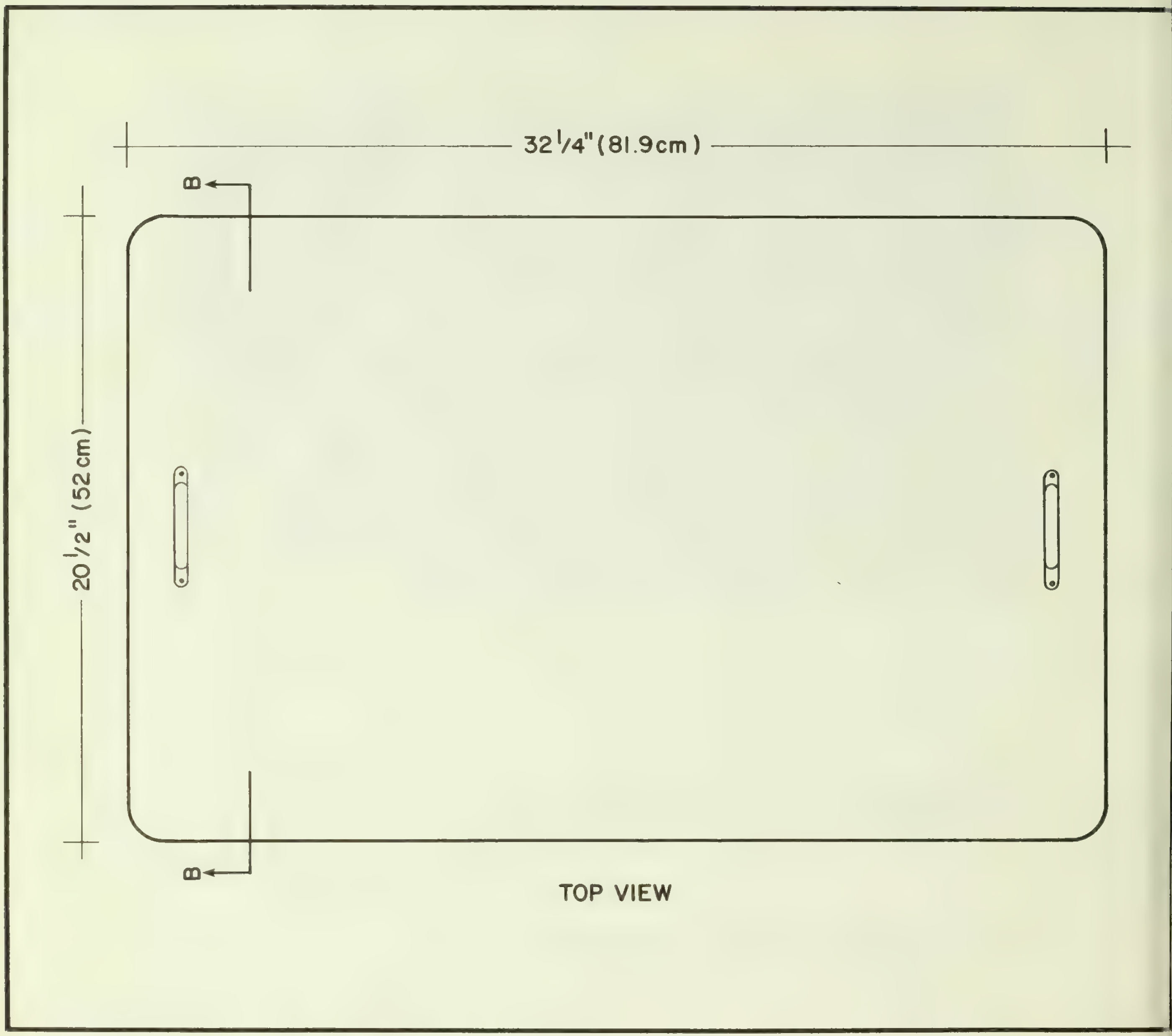
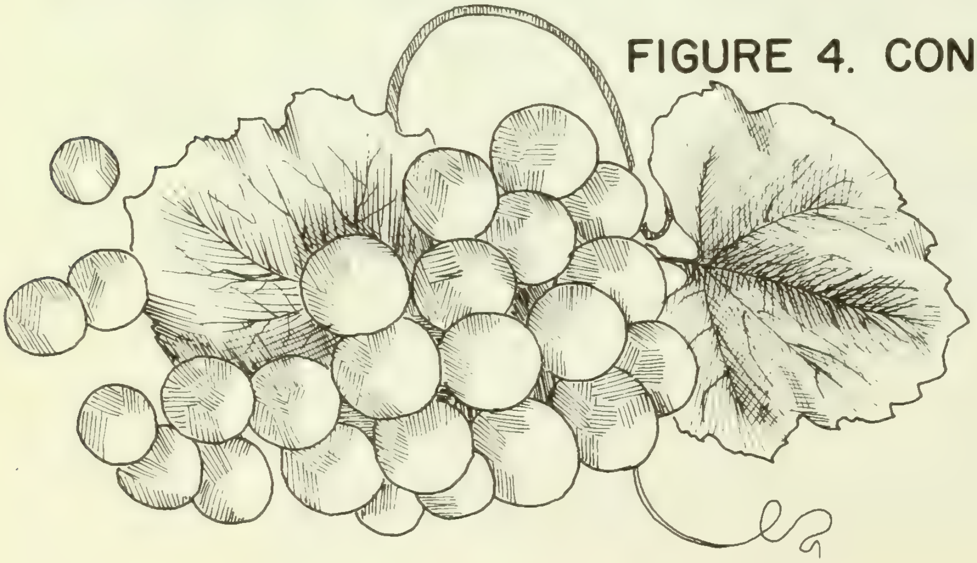
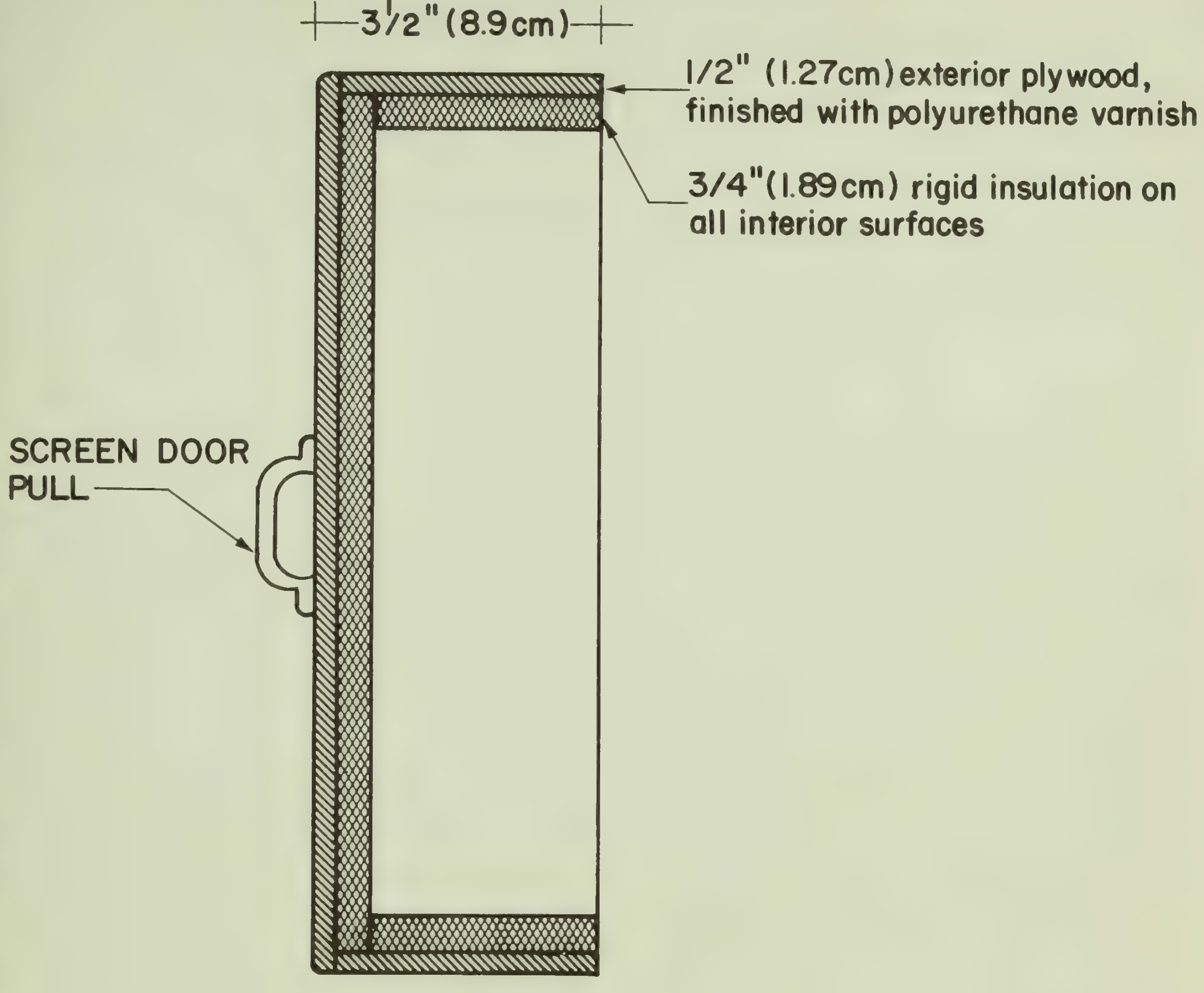

32 1/4" (81.9cm)
B
20 1/2" (52 cm)
B
TOP VIEW

FIGURE 4. CONSTRUCTION DRAWIN




3 1/2" (8.9 cm)
1/2" (1.27cm) exterior plywood, finished with polyurethane varnish
3/4" (1.89 cm) rigid insulation on all interior surfaces
SCREEN DOOR PULL

SECTION BB

F INSULATED PLYWOOD COVER

References Cited

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2. Amerine, M. A. and V. L. Singleton. 1977. Wine, An Introduction, 2nd Edition. University of California Press, Los Angeles, CA.

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Bulletin 895 July 1981

Cotton
Cotton
Cotton
Cotton

SEP 18 1981
Mississippi State, University

Cotton Response to Subsoiling and Chiseling of Sandy Loam Soil

G. R. Tupper • W. I. Spurgeon

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R. RODNEY FOIL, DIRECTOR MISSISSIPPI STATE, MS 39762

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James D. McComas, President Louis N. Wise, Vice President

Summary

G. R. Tupper, agricultural engineer **W. I. Spurgeon**, agronomist
both with the MAFES Delta Branch

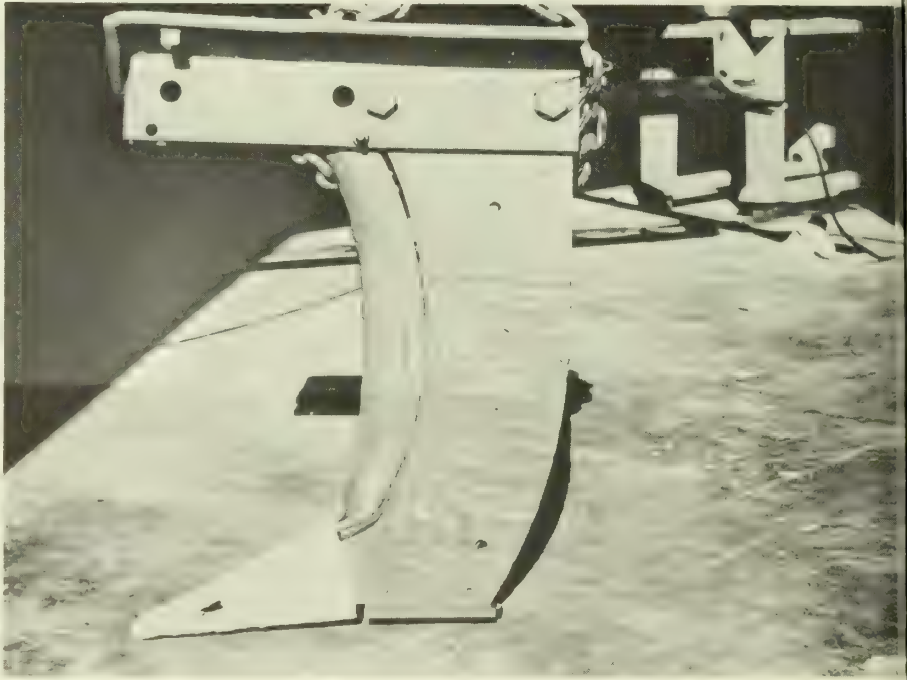
The major hardpan of the test site was between 9 and 12 inches below the soil surface. Both subsoilers penetrated the pan, but the chisel operated above it and generally had a detrimental effect when used either with or without subsoiling, the exception being in 1977 with the Parabolic Subsoiler.

Total lint yields in the fourth year of the study were highest on plots that were chiseled after subsoiling with the Stoneville Parabolic Subsoiler, but did not differ significantly from the check or from the other treatments. Measurements of earliness, taproot length and residual soil strength for the check in the fourth year of the study did not differ significantly from those for the deep-tillage treatments.

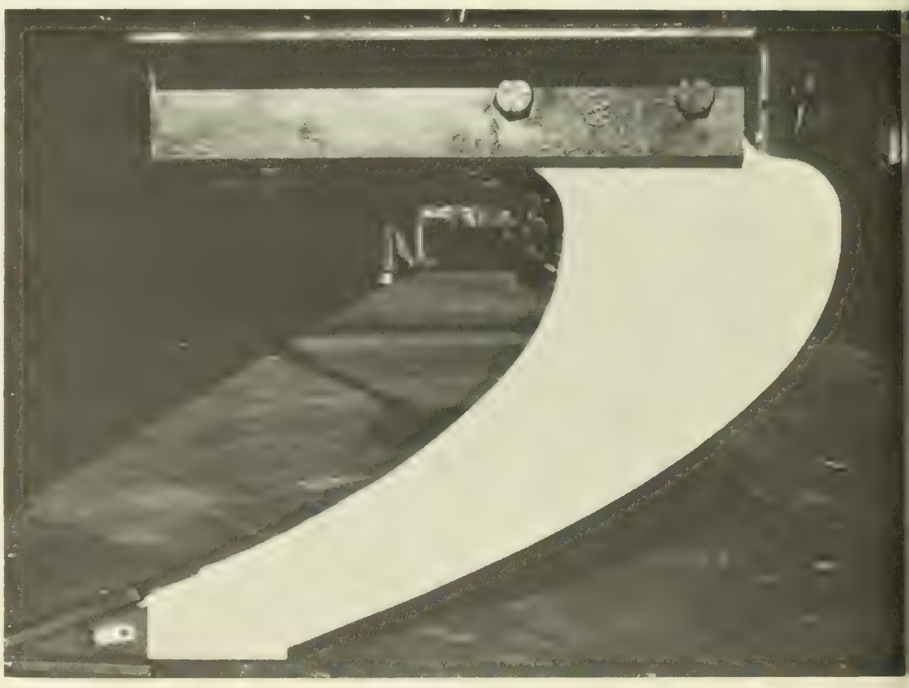
Lint yields of the check (averages of three years for which data were taken) did not differ significantly from those for the deep-tillage treatments. First-harvest lint yields averaged over the same three years were highest on the treatments subsoiled conventionally or with the Parabolic Subsoiler, but percentages of total yield from these plots at first harvest did not differ significantly from the check. Taproots were longest (three-year average) for the parabolic-subsoiled treatment but were not significantly longer than for the conventionally subsoiled treatment and plots chiseled after subsoiling with the Parabolic Subsoiler. The three-year average residual soil strength of deep-tilled treatments did not differ significantly from that of the check.

In averaging all plots subsoiled with the Parabolic Subsoiler as compared to the non-subsoiled plots, lint at second harvest, total lint and cottonseed harvested were higher, taproots were longer and residual soil strength was lower for parabolic subsoiling.

On Bosket fine sandy loam sc the spring tine chisel decreased t total lint harvested and delay maturity.



Conventional Subsoiler used in the trial.



Stoneville Parabolic Subsoiler

Cotton Response to Subsoiling and Chiseling of Sandy Loam Soil

Cotton yield increases from subsoiling or deep tillage of sandy, sandy loam and silt loam soils have been reported in the Delta of Mississippi (3,5,9). Many areas outside the Delta also have reported that deep tillage has resulted in significant increases in cotton yields where soil compaction problems limit water intake and storage and root development (2,4).

Veihmeyer and Hendrickson (10) found that root penetration problems occurred at much lower densities on clay soils than on sandy soils because of smaller size of pores. Research indicated that roots of plants, growing in a rigid system where soil particles cannot be moved aside, cannot penetrate pore spaces with diameters smaller than the root tip diameter (12). Taylor and Gardner (7) reported that cotton roots can penetrate a nonporous region only if it is not rigid. Deep tillage of compact soils increases root penetration by increasing pore size and reducing the rigidity of soil particles, along with other benefits; e.g., increased water infiltration and oxygen content of the tilled area.

Severity of soil compaction is influenced by the soil management system used. Vomocil, et al (11) found that the rate of water infiltration into soil was reduced after a tractor had operated on tilled soil, with drawbar pull of the tractor increased as a means of increasing wheel slippage and compaction. Water run-off and erosion usually increase when the water-infiltration rate of soil decreases.

These studies suggest that minimum or reduced soil-management tillage systems will help increase the intake of water, reduce erosion, increase aeration and improve root penetration. Machine design and operation will have to be integrated into a workable soil-management system before optimum compaction control can be attained.

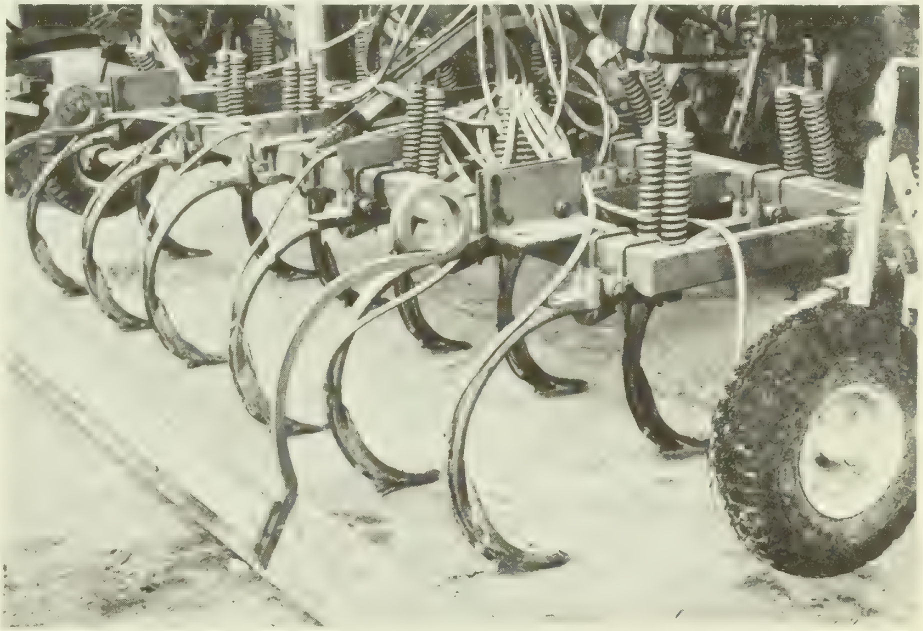
Studies of a Bosket fine sandy loam by Spurgeon et al (6) showed that cotton yields were higher after limited seedbed preparation than after disking and chiseling twice after subsoiling. The limited seedbed preparation consisted of subsoiling at an angle to the row and hipping over the old stubble.

The Stoneville Parabolic Subsoiler was designed in 1972 (8). Field tests comparing the Parabolic Subsoiler with a conventionally designed subsoiler showed decreased horsepower requirement, increased width of soil fracture and a 43.4% reduction in tractor wheel slippage for subsoiling with the Parabolic Subsoiler (9).

Procedure

Tests on a Bosket fine sandy loam were conducted at the MAFES Delta Branch in 1974, 1975, 1976* and 1977. The experiment was a factorial arrangement of a randomized block design with four replications, and each plot was six 40-inch wide and 100-ft long rows. The identity of each plot was retained throughout the four years of the trial.

The deep-tillage treatments tested were (1) check - no subsoiling, (2) subsoiling 16 inches deep in the drill with a conventional subsoiler, and (3) subsoiling 16 inches deep in the drill with the Stoneville Parabolic Subsoiler. Each of the deep-tillage treatments had one of two additional tillage



Spring Tine Chisel Used in the Trial

*Dates of treatment and results of the 1976 trial are not reported because data were destroyed by a picking error.

treatments---(1) none - no chiseling, and (2) chiseling 7 inches deep with a spring tine chisel on 12-inch centers in the row direction. Cultural practics on all plots were identical except for the tillage treatments.

Subsoiling was done February 28, 1974, January 30, 1975 and February 17, 1977 and chiseling was done March 6, 1974, March 24, 1975 and February 25, 1977. Dates of tillage differed because of variations in soil conditions and weather from one year to another.

All plots were hipped over the old stubble (6) before applying a 32% urea-ammonium nitrate solution (80 lbs/acre), and the plots were hipped again. A bed conditioner (Do-All) was used to knock the beds down ahead of the planter, and 'Stoneville 213' seed (20 lbs/acre) were planted April 26, 1974, April 28, 1975 and April 26, 1977.

Diuron was applied preemergence and conventiona cultivation and postemergenc weed control practices were used Insecticides were applied by air a needed.

The tests were defoliated a maturity, and the center two row of each plot were harvested twic each year with a spindle picker.

Samples were ginned on a 20-saw gin with a standard equipmen sequence (1).**

Table 1. Yield, earliness and taproot length of 'Stoneville 213' cotton on a Bosket fine sandy loam and residual strength of the soil after deep tillage, by tillage treatment, MAFES Delta Branch, 1974.

Tillage treatment		Seed cotton			Lint				Earliness		Residual
Subsoil	Chisel	1st	2nd	Total	1st	2nd	Total	Cottonseed	Lint at 1st pick	Taproot length[1]	soil strength[2]
		(lbs/acre)							(%)	(in)	(lbs/sq in)
None	None	1921 ab[3]	745 c	2666	614 a	226 b	840 ab	1582	73.2 a	7.0 bc	536
None	Chisel	1755 bc	945 abc	2700	529 b	286 ab	815 ab	1614	65.3 b	6.2 c	564
Conventional	None	1986 a	785 bc	2771	619 a	232 b	851 ab	1642	72.7 a	8.1 abc	546
Parabolic	None	1936 ab	955 ab	2931	583 ab	309 a	892 a	1734	65.4 b	10.3 a	431
Conventional	Chisel	1900 ab	956 abc	2856	561 ab	287 ab	848 ab	1694	66.0 b	7.3 bc	514
Parabolic	Chisel	1697 c	1036 a	2733	481 c	310 a	791 b	1603	60.9 b	9.1 ab	471
Treatment Means											
None		1838	845 b	2683	572 a	255 b	827	1598	69.2 a	6.6 b	550 b
Conventional		1943	870 b	2813	590 a	260 b	850	1668	69.4 a	7.7 b	530 ab
Parabolic		1817	1015 a	2832	532 b	310 a	842	1668	63.1 b	9.7 a	451 a
	None	1948 a	841 b	2789	605 a	256 b	861 a	1653	70.4 a	8.5	504
	Chisel	1748 b	979 a	2763	524 b	294 a	818 b	1637	64.1 b	7.5	516

[1] Average of 10 consecutive plants from each plot after harvest.

[2] Measurements made about 11 months after subsoiling from 10 readings per plot when soil moisture was high.

[3] Values in each column and group followed by the same letter are not significantly different ($P < .05$) as determined by Duncan's New Multiple Range test.

Table 2. Yield, earliness and taproot length of 'Stoneville 213' cotton on a Bosket fine sandy loam and residual strength of the soil after deep tillage, by tillage treatment, MAFES Delta Branch, 1975.

Tillage treatment		Seed cotton			Lint						Residual
Subsoil	Chisel	1st	2nd	Total	1st	2nd	Total	Cottonseed	Lint at 1st pick	Taproot length[1]	soil strength[2]
		(lbs/acre)							(%)	(in)	(lbs/sq in)
None	None	2390 ab[3]	838 c	3228 ab	716 ab	277 c	933	1903 ab	72.0 a	6.5 c	474
None	Chisel	1998 b	956 bc	2954 b	611 ab	343 b	954	1732 b	63.8 bc	6.9 c	470
Conventional	None	2419 ab	974 b	3393 ab	746 a	348 b	1094	1991 ab	68.3 ab	9.7 a	366
Parabolic	None	2557 a	987 b	3544 a	733 a	367 ab	1120	2093 a	67.2 ab	10.1 a	375
Conventional	Chisel	2042 ab	1160 a	3202 ab	575 b	411 a	986	1888 ab	58.2 c	7.4 bc	349
Parabolic	Chisel	2176 ab	996 b	3172 ab	652 ab	351 b	1003	1814 ab	64.5 b	9.1 ab	393
Treatment Means											
None		2194	897 b	3091	663	310 b	973	1817	67.9 a	6.7 c	472 b
Conventional		2231	1067 a	3298	660	380 a	1040	1939	63.2 b	8.5 b	357 a
Parabolic		2366	992 a	3358	702	359 a	1061	1953	65.9 ab	9.6 a	384 ab
	None	2455 a	933 b	3388	738 a	331 b	1069 a	1995 a	69.1 a	8.8	405
	Chisel	2072 b	1037 a	3109	613 b	368 a	981 b	1811 b	62.2 b	7.8	404

[1] Average of 10 consecutive plants from each plot after harvest.

[2] Measurements made about 11 months after subsoiling from 10 readings per plot when soil moisture was high.

[3] Values in each column and group followed by the same letter are not significantly different ($P < .05$) as determined by Duncan's New Multiple Range Test.

***Cotton was ginned at the U. S. Cotton Ginning Research Laboratory at Stoneville, Mississippi.*

Results

Total lint yield in 1974 was highest for parabolic subsoiling but differed significantly ($P < .05$) only from the parabolic subsoiling plus chiseling treatment (Table 1). The highest lint yield in 1975 was from the parabolic-subsoiled plots but was not significantly different from yield of other plots (Table 2). Lint yield in 1977 was highest with parabolic subsoiling plus chiseling but was not significantly higher than yield of other plots (Table 3). The highest three-year average yield was from the parabolic-subsoiled treatment but was not significantly higher than that of the check (Table 4).

Table 3. Yield, earliness and taproot length of 'Stoneville 213' cotton on a Bosket fine sandy loam and residual strength of the soil after deep tillage, by tillage treatment, MAFES Delta Branch, 1977.

Tillage treatment		Seed cotton			Lint						Residual
Subsoil	Chisel	1st	2nd	Total	1st	2nd	Total	Cottonseed	Lint at 1st pick	Taproot length[1]	soil strength[2]
		(lbs/acre)							(%)	(in)	(lbs/sq in)
None	None	1815	639 ab[3]	2454	597	211 ab	808	1500	74.1 bc	7.1	565 ab
None	Chisel	1769	632 ab	2401	572	213 ab	785	1442	73.0 c	6.9	686 ab
Conventional	None	1826	618 ab	2444	600	210 ab	810	1465	74.3 bc	9.1	520 ab
Parabolic	None	1920	516 ab	2436	650	171 bc	821	1475	79.4 ab	8.3	651 ab
Conventional	Chisel	1915	475 b	2390	642	155 c	797	1479	80.8 a	7.7	714 ab
Parabolic	Chisel	1929	675 a	2604	631	235 a	866	1752	72.8 c	8.9	389 a
Treatment Means											
None		1792	636	2428	585 b	212	797	1471	73.5	7.0	626
Conventional		1879	546	2416	621 ab	183	804	1472	77.6	8.4	617
Parabolic		1925	595	2520	640 a	203	843	1614	76.1	8.6	520
	None	1853	591	2444	616	197	813	1480	75.9	8.2	579
	Chisel	1871	594	2465	615	201	816	1588	75.5	7.8	596

[1] Average of 10 consecutive plants from each plot after harvest.

[2] Measurements made about 11 months after subsoiling from 10 readings per plot when soil moisture was high.

[3] Values in each column and group followed by the same letter are not significantly different ($P < .05$) as determined by Duncan's New Multiple Range Test.

Table 4. Yield, earliness and taproot length of 'Stoneville 213' cotton on a Bosket fine sandy loam and residual strength of the soil after deep tillage, by tillage treatment, MAFES Delta Branch, averages of 1974, 1975 and 1977.

Tillage treatment		Seed cotton			Lint						Residual
Subsoil	Chisel	1st	2nd	Total	1st	2nd	Total	Cottonseed	Lint at 1st pick	Taproot length[1]	soil strength[2]
		(lbs/acre)							(%)	(in)	(lbs/sq in)
None	None	2042 ab[3]	740 b	2782 ab	643 ab	237 b	880 abc	1661 ab	73.1 a	6.9 b	523 ab
None	Chisel	1841 c	845 ab	2686 b	571 c	280 a	851 c	1596 b	67.4 cd	6.7 b	573 b
Conventional	None	2077 ab	792 ab	2869 ab	655 a	263 ab	918 ab	1699 ab	71.8 ab	9.0 a	477 ab
Parabolic	None	2137 a	833 ab	2970 a	662 a	282 a	944 a	1767 a	70.6 abc	9.5 a	486 ab
Conventional	Chisel	1952 abc	864 a	2816 ab	593 bc	284 a	877 bc	1687 ab	68.3 bcd	7.5 b	525 ab
Parabolic	Chisel	1934 bc	902 a	2836 ab	588 bc	298 a	886 abc	1723 ab	66.1 d	9.0 a	418 a
Treatment Means											
None		1941	793	2734 b	607	259 b	866 b	1629 b	70.2	6.8 c	549 b
Conventional		2014	828	2842 ab	624	274 ab	898 ab	1693 ab	70.0	8.2 b	501 ab
Parabolic		2036	867	2903 a	625	290 a	915 a	1745 a	68.4	9.3 a	452 a
	None	2086 a	788 b	2874	653 a	261 b	914 a	1709	71.8 a	8.5	496
	Chisel	1909 b	870 a	2779	584 b	288 a	872 b	1669	67.3 b	7.7	506
Year											
1974		1866 b	910 a	2776 b	564 b	275 b	839 b	1645 b	67.2 b	8.0	510 a
1975		2264 a	985 a	3249 a	676 a	349 a	1025 a	1903 a	65.7 b	8.3	404 b
1977		1862 b	593 b	2455 c	615 b	199 c	814 b	1519 b	75.7 a	8.0	587 a

[1] Average of 10 consecutive plants from each plot each year after harvest.

[2] Measurements made about 11 months after subsoiling from 10 readings per plot each year when soil moisture was high.

[3] Values in each column and group followed by the same letter are not significantly different ($P < .05$) as determined by Duncan's New Multiple Range Test.

Lint yields at first harvest in 1974 and 1975 were highest on conventionally subsoiled plots but did not differ significantly from the check. The largest first-harvest lint yield in 1977 was on parabolic-subsoiled plots, but the percentage of total yield picked at first harvest differed significantly only from the chiseling only and the parabolic-subsoiling plus chiseling treatments. First-harvest lint yields averaged over the three years were highest on plots subsoiled with the Parabolic Subsoiler or subsoiled conventionally, but percentages of total yield from these plots at first harvest did not differ significantly from the check.

Taproots generally were shorter on the check and on plots that were chiseled only. The longest taproots in 1974 and 1975 were found on the parabolic-subsoiled treatment, significantly longer than those from the check, chiseling only or conventional subsoiling plus chiseling. Taproots in 1977 were longest on conventionally subsoiled plots but were not significantly longer than for the check or the other treatments. The three-year average length of taproots from the parabolic-subsoiled plots was 9.5 inches, significantly longer than those from the check, chiseling only or conventional subsoiling plus chiseling.

Soil strength about 11 months after deep tillage generally was more variable than other measurements but tended to be lower after subsoiling and was highest after chiseling only. Residual soil strength in 1974, 1975 and 1977 was lowest after parabolic subsoiling, conventional subsoiling plus chiseling and parabolic subsoiling plus chiseling, respectively.

In averaging the treatmen means over the three-year period the Parabolic Subsoiler increased the amount of lint at second harvest, total lint and cottonseed harvested, significantly more than non-subsoiled treatments. The taproots were significantly longer for the parabolic subsoiled plots. Residual soil strength was significantly lower for the parabolic subsoiled plots approximately 11 months after subsoiling when compared to the non-subsoiled treatments.

In this test on Bosket fine sandy loam soil, the spring tine chisel increased second harvest lint yield but decreased first harvest and total lint yields, as well as delaying maturity significantly.

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Stand-Age Analysis of Timber on Mississippi's Private, Nonindustrial Forests

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1878

STAND–AGE ANALYSIS OF TIMBER ON MISSISSIPPI'S PRIVATE, NONINDUSTRIAL FORESTS

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Summary & Conclusions

Most of the current pine timber acreage in Mississippi developed through the reversion of large acreages of agricultural cropland to forestry. Now that cropland retirement has ceased, management practices must provide for pine regeneration on existing forest lands. Harvesting practices that remove higher-valued pine timber from private, nonindustrial pine lands have created large acreages of poorly stocked, low quality hardwood stands.

Effective provision for softwood regeneration at the time of final harvest is essential to the future of the State's forest economy. Present rates of pine regeneration will not sustain present softwood production in Mississippi beyond the next 20 years.

There will be enough pine timber to satisfy the industrial wood requirements in Mississippi, at current consumption levels, through the year 2000 A. D. Private, nonindustrial landowners must contribute a large portion of this raw material requirement. Industrial expansion appears to be most attractive in the North Region where much more softwood is being grown than is being cut. Any sustained increases in the State's short-run softwood consumption, however, must result from increased production per acre through improved technology, management and utilization.

Poor regeneration on private, nonindustrial lands cut in the last 20 years may constrain softwood consumption by about the year 2000 A. D. Constrained future availability of pine timber and the forest industry's continued dependence on private, nonindustrial timber supplies provide a favorable outlook for today's forestry investments. Individuals often reject forestry investments because of the long time period, high time preference for money and uncertain stumpage prices. Landowners with pine stands less than 30 years old need to be encouraged to invest in cultural practices that will help produce more sawtimber at the turn of the century. Private, nonindustrial forests, as a productive resource, are vital to Mississippi's economy, and the outlook is bright for individuals with the foresight to invest now in future pine production.

Continuation of present pine regeneration trends on private, nonindustrial ownerships developed over the past 10 years will lead to a major reduction in pine forest types available for harvest after 2000-2010 A. D. The anticipated shortfall in Mississippi 20 to 30 years from now can be reduced if regeneration efforts are encouraged. The private, nonindustrial ownership group must double regeneration performance over the next decade. This goal can be accomplished only with a well coordinated cooperative effort on the part of all concerned groups, agencies, companies and professionals. Investments in forest industry development will not be undertaken without assurances that future raw material supplies will be adequate. Future raw material supplies in Mississipp will be determined to a large extent by regeneration accomplishments on private, nonindustrial ownerships.

Current public assistance programs are working, but these programs are restrained by limited budgets and manpower of the sponsoring agency. The current public assistance programs must be increased by 33% to guarantee a minimum of 400,000 acres of pine regeneration in the 1980s. Forest industries bear much responsibility for future softwood availability, and their management needs to consider the benefits possible from the increasing landowner assistance progams.

Stand-Age Analysis of Timber on Mississippi's Private,Nonindustrial Forests

Forestry dominates land use in Mississippi with 55% of the total land area classified as commercial forest, and 73% of this is in private, nonindustrial ownerships (Moak 1977). Therefore, private, nonindustrial forests must contribute a high proportion of future industrial wood requirements. This report focuses on the relationship of the present age distribution of Mississippi's softwood timber to the future availability of timber.

Stand-age profiles may be used to define the age-class distribution of an even-aged forest, with each age class represented by areas of equal productivity in an optimum regulated situation (Knight 1977). A balanced age-class distribution permits sustained harvest at a constant rate over time, but shortfalls and overages may occur because of changing economic circumstances. We present in this bulletin current stand-age profiles of Mississippi's forest resource as a guide to projecting potential problems in timber availability. The primary emphasis of the publication is on nonindustrial, private landowners and the forest resource base controlled by this group.

Highlights

Pine regeneration reached a high level in Mississippi in the early 1950s. Almost 1.2 million acres of pine on all ownerships is now between 20 and 29 years old. Pine regeneration, particularly on the private, nonindustrial ownerships, has declined by about 50% since the early 1950s, and less than 600 thousand acres of pine in Mississippi are in the less than 10 years-old age class (Figure 1a).

Private, nonindustrial owners control a major portion of Mississippi's valuable pine and oak-pine forest lands. Therefore, the state's future timber economy will be determined largely by the management and investment decisions of these forest landowners.

Stand-Age Profiles

Statewide Analysis

Stand-age profiles were developed for Mississippi to provide information on prospective softwood availability from private, nonindustrial forests over the next 30-40 years. The data were derived from 1977 Forest Survey plot summaries provided by the Southern Forest Experiment Station, U. S. Forest Service, New Orleans, Louisiana.

We define an ideal stand age distribution as equal acreages among stand-age classes up to a rotation age. Uniform age-class distributions permit a sustained allowable cut based on area control. Statewide differences in objectives, ownerships, species, sites, markets and other factors cause acreage variations among age classes, but general analyses of stand-age patterns provide an assessment of future softwood availability. This stand-age analysis of Mississippi's timberland provides particular insight because most of the State's timber stands are classified as even age[1] (Figure 1).

Statewide stand-age profiles are very unbalanced (Figure 1). Private, nonindustrial ownerships dominate nearly all age classes and forest types and contribute significantly to the uneven distribution below age 40. Age classes 20-29 and 30-39 years are consistently high regardless of forest

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[1] *Even-aged stands defined by the USFS Forest Survey occur when 50% of the dominant and codominant trees are within a single 20 year age class.*

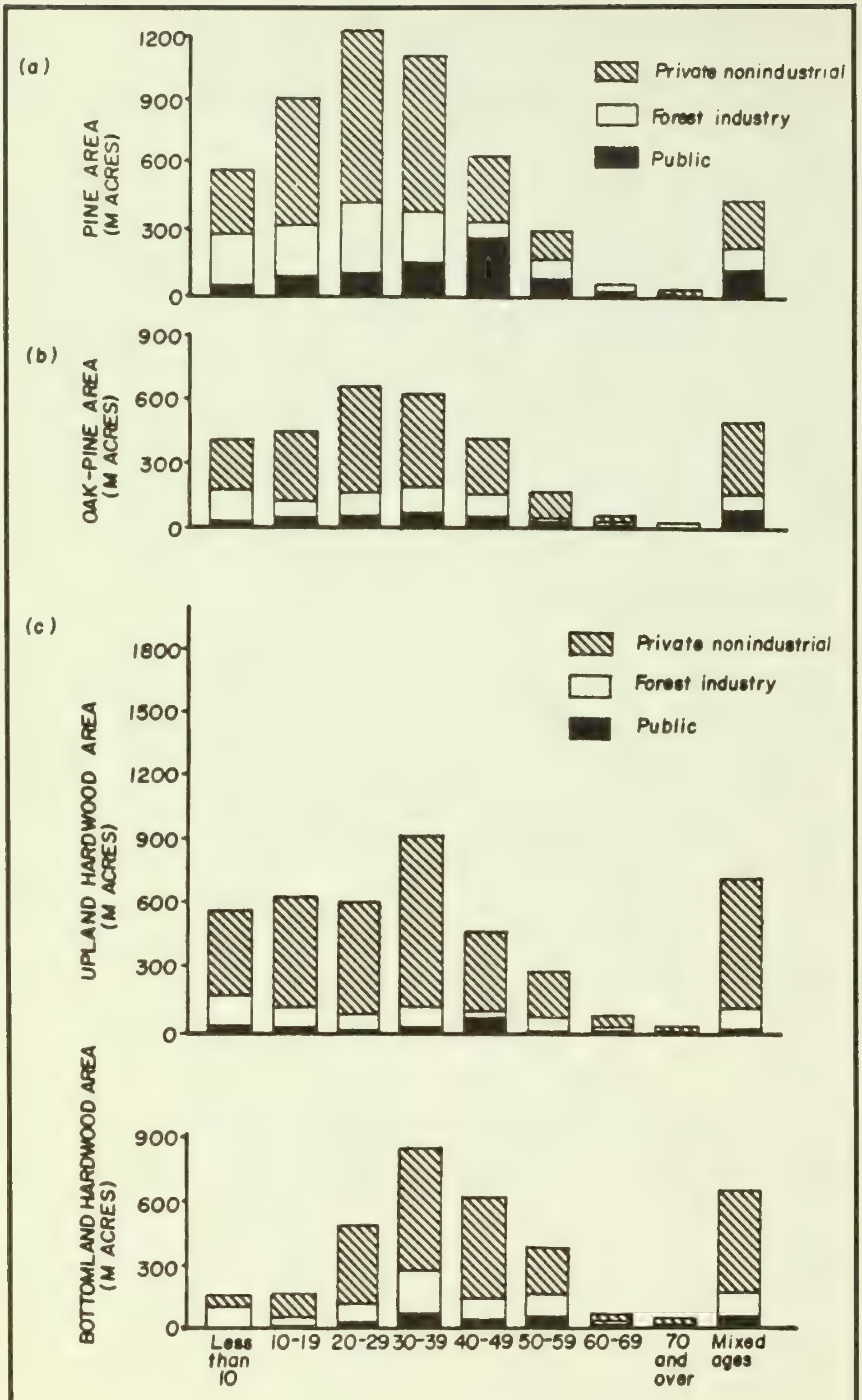


Figure 1. Area of commercial Forest Land in pine, oak-pine and hardwood forest types, by stand-age class and ownership class, Mississippi, 1977

type. This condition result primarily from the high rates o cropland retirement in Mississipp during the late 1940s and earl 1950 s. The relatively low acreage in the older age classes indicat that much of the area that reverte to forestry more than 40 years ag has been harvested.

Age classes less than 10 and 10 t 19 years (Figure 1a) provide measure of pine regeneration. Mississippi's forest industry is produc ing reasonably well-balanced age class distributions of pine throug regeneration efforts on industria holdings, but this is not occurrin on private, nonindustrial lands Private, nonindustrial pine fores types include 811 M acres in the 2 to 29-years age class, 575 M acres i the 10- to 19-years age class an only 293 M acres in the less than 1 years age class. The smaller pin acreages in the younger age classe on private, nonindustrial land have resulted from discontinue cropland retirement and post-harvest invasion of hardwoods o many pine sites harvested in th last 20 years. This hardwood encroachment has resulted in mor uniform age-class distributions i the oak-pine and upland hardwoo forest types (Figures 1b & c).

Most private, nonindustria landowners have never perceive that investing in pine regeneratio is to their economic self-interes (Boyce and Knight 1977). Th southern pine timber availabl today occurs primarily becaus retired farmland seeded naturall from adjacent stands. Owners these lands did not intentionall plan for Mississippi's preser softwood resource but merely sa personal advantages from n farming. There have been no ne additions of pine-regenerated acre to the forest land base since th discontinuation of cropland retirement about 15 to 20 years ago. As result, only 9% of Mississippi's 3. million acres of private, nonindustrial pine forests is less than 1 years old. Many private, nonindustrial pine stands harvested in the last 20 years have reverted to poor quality, low value hardwoods. Consequently, future softwood supplies may be limited. Providing pine regeneration after harvest of pine lands is essential if Mississippi's current softwood production is to be maintained beyond the next 20 years.

The full impact of current state and federal assistance programs on private, nonindustrial reforestation is not reflected in Figure 1 because these programs were initiated only a few years before the 1977 Forest Survey. The Forest Incentives Program (FIP) and Mississippi's Forest Resource Development Program (FRDP) will have a significant impact on future pine age-class distributions at the present 30 M-acre annual rate of planting and seeding private, nonindustrial land. However, these programs will not create a balanced distribution at current levels of regeneration. Program accomplishments will have to increase 33% to guarantee 400,000 acres of pine regeneration in Mississippi during the 1980s.

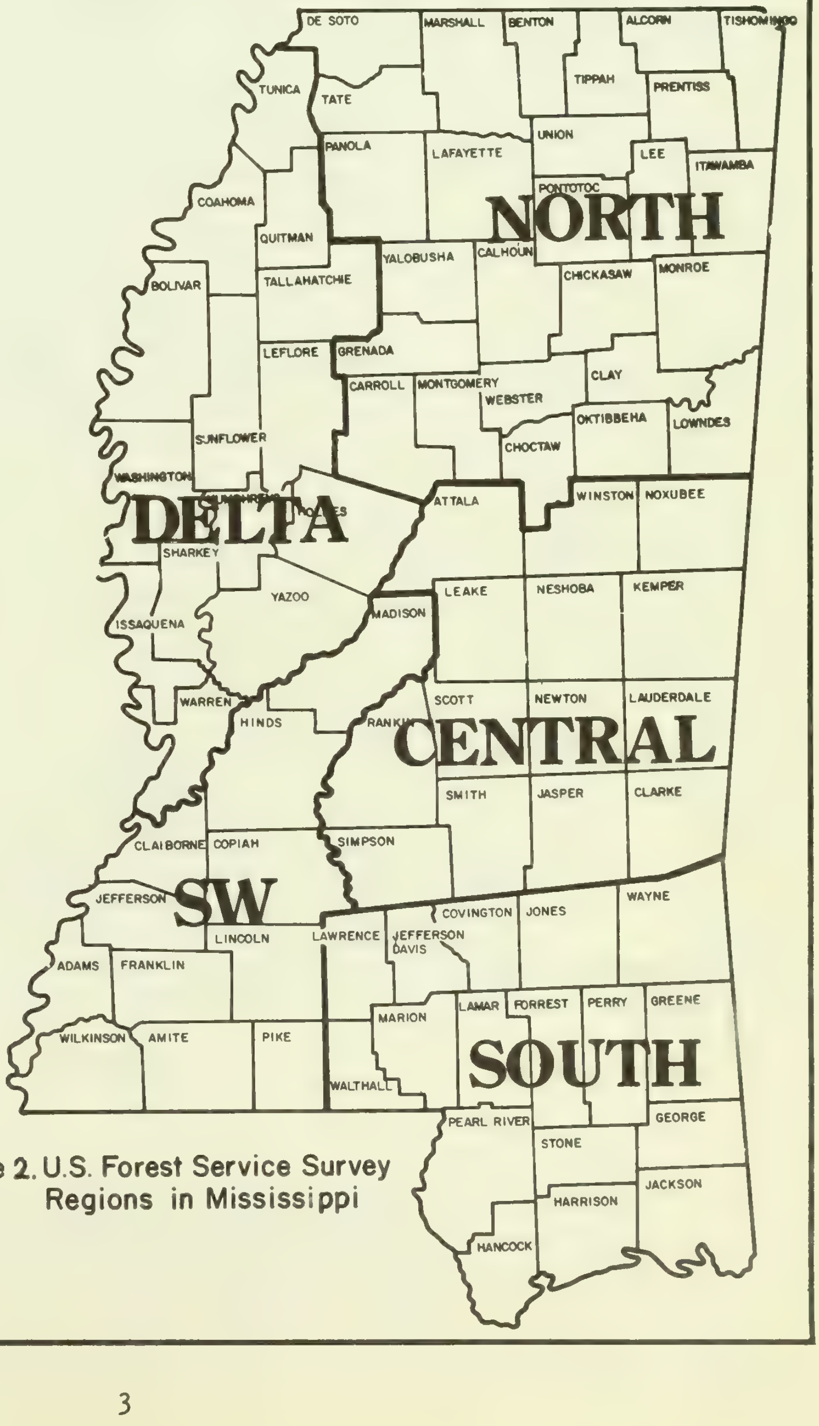
Regional Analysis

The U. S. Forest Service divides Mississippi into five regions based on physical geography (Figure 2). Stand-age profiles for the Delta, North, Central, South and Southwest Regions are presented in Figures 3 to 7, respectively. The upland and bottomland hardwood forest types were analyzed as a single hardwood category in this study.

Delta Region---Pine and oak-pine forest types occupied a relatively small acreage in the region and are omitted from Figure 3. The total forested acreage in the Delta is diminishing over time, and smaller acreages in the younger age classes have resulted. This trend is expected to continue as harvested private, nonindustrial acreage is converted to agricultural use.

North Region---Private, nonindustrial ownership's dominate forest types and age classes in the region (Figure 4). A large proportion of the commercial forest land is in private, nonindustrial hardwoods. The relatively high proportion of private, nonindustrially owned pine growing stock reaching pulpwood and small sawlog ages may be the result of planting efforts on the Yazoo-Little Tallahatchie Watershed.

Central Region---Private, nonindustrial landowners control much of the acreage of merchantable-age stands (Figure 5). The stand-age profile (Figure 5a) indicates significant decreases in total pine area as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AMITE
PIKE
SOUTH
WALTHALL
PEARL RIVER
GEORGE
STONE
JACKSON
HARRISON
HANCOCK

Figure 2. U.S. Forest Service Survey Regions in Mississippi

stand age decreases. The acreage decreases are due chiefly to private, nonindustrial timber-harvesting activity.

South Region---The region has a relatively lower proportion of oak-pine and hardwood forest types, irrespective of ownership class (Figure 6). The dominance of pine forest types over other forest types occurs across all age classes. Industry is less dependent on private, nonindustrial lands for softwood supply than in other regions. High industrial wood consumption and Hurricane Camille resulted in a softwood inventory increase of only 8% from 1967 to 1977 (Murphy 1978). Areas damaged by Hurricane Camille in 1969 have since been reforested, and age class is more balanced. More recent damage by Hurricane Frederick, not reflected in this analysis of 1977 data, may result in another imbalance between softwood growth and removals.

Southwest Region---This is geographically the smallest forest survey region in the state. A high proportion of the total forested area is in private, nonindustrial ownerships and covered with hardwood forest types. Future softwood availability becomes a problem in this region because of lower pine acreages in younger age classes, the proximity of high levels of industry activity and a high level of private, nonindustrial ownership.

All Regions---Several implications for the future may be drawn from the regional stand-age analyses. The Delta produces very little softwood material and is not expected to contribute significantly to future softwood requirements. The North Region has a high proportion of softwood growing stock reaching merchantable age and offers opportunities for industrial expansion. Two pulpmills will be constructed in this Region

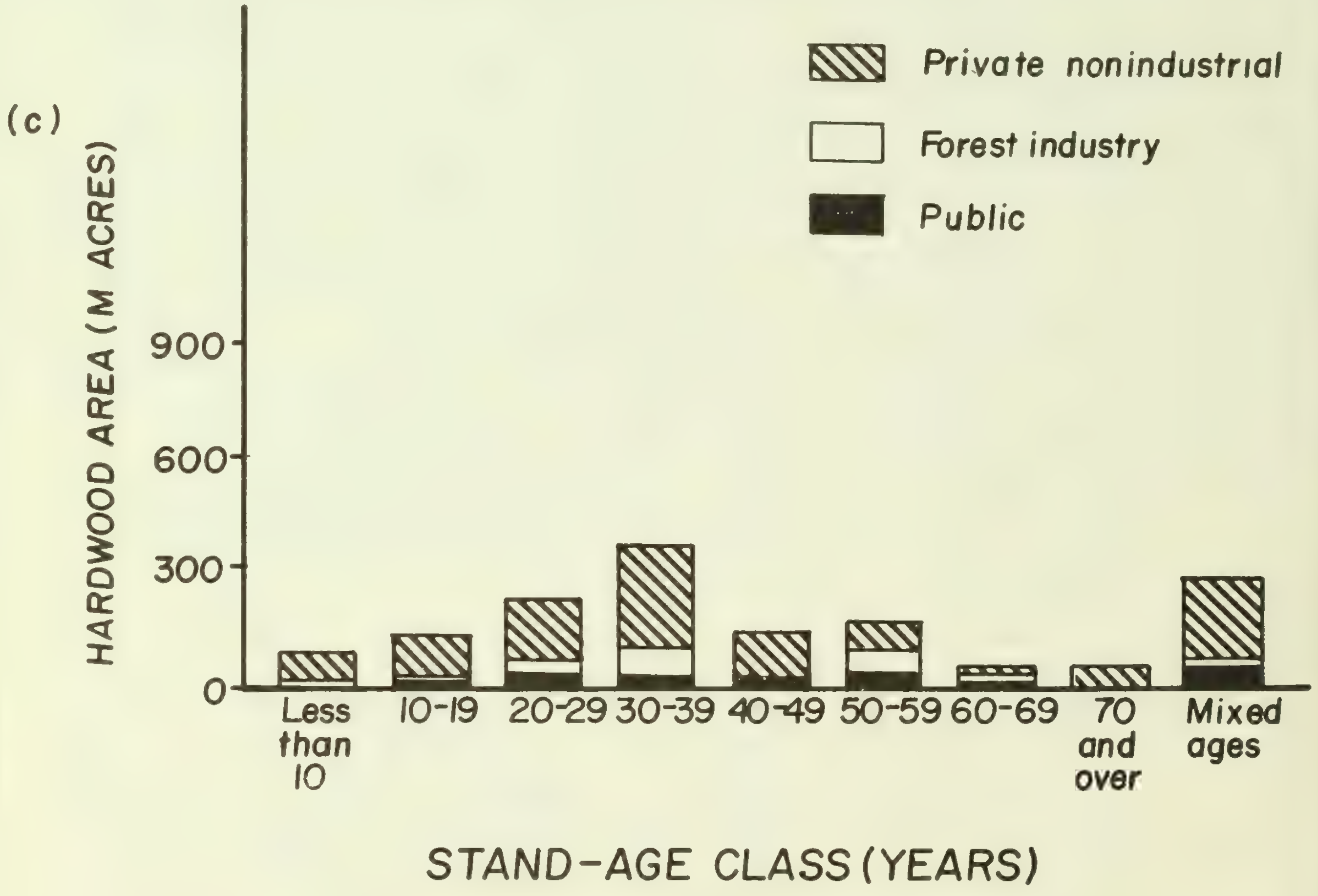

Figure 3. Area of commercial Forest Land in hardwood forest types, by stand-age class and ownership class, Delta Region, 1977

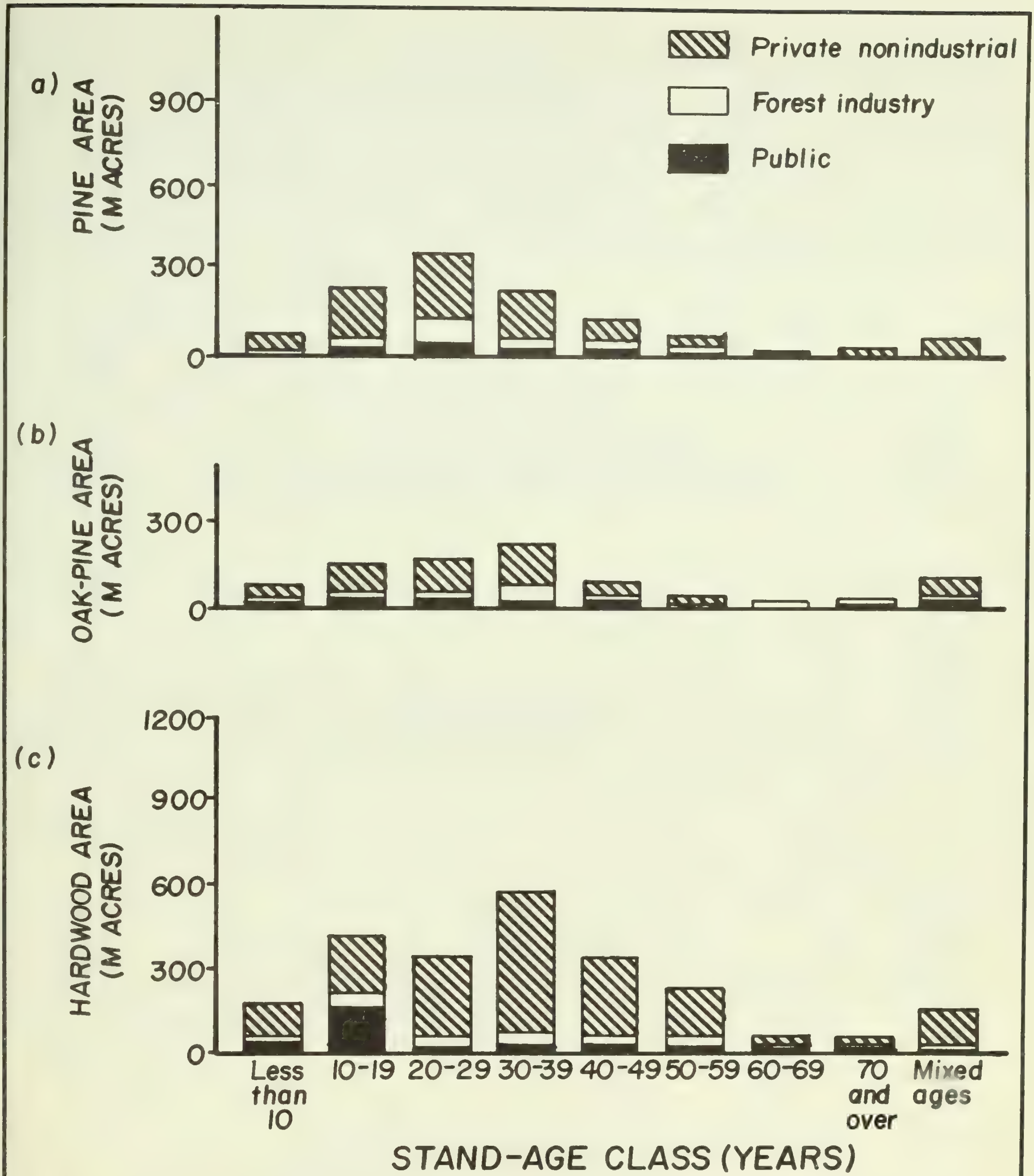

Figure 4. Area of commercial Forest Land in pine, oak pine, and hardwood forest types, by stand-age class and ownership class, North Region, 1977

during the 1980s. The North Region experienced a 78% net gain in softwood growing-stock volume from 1967 to 1977 (Murphy 1978). The Central and the North Regions offer many opportunities for increasing future softwood production. Both regions contain large acreages of private, nonindustrial upland hardwoods that could be converted to pine forest types. Industry in the Central Region will be able to sustain harvests from company lands, but competition for private, nonindustrial softwoods will increase as future supplies become more restricted. Improving forest management will become more attractive to individual landowners as their resource becomes more valuable and markets improve.

The stand-age distribution of softwoods in the South Region is nearly balanced. Future expansion by the forest industry in the region does not appear likely without

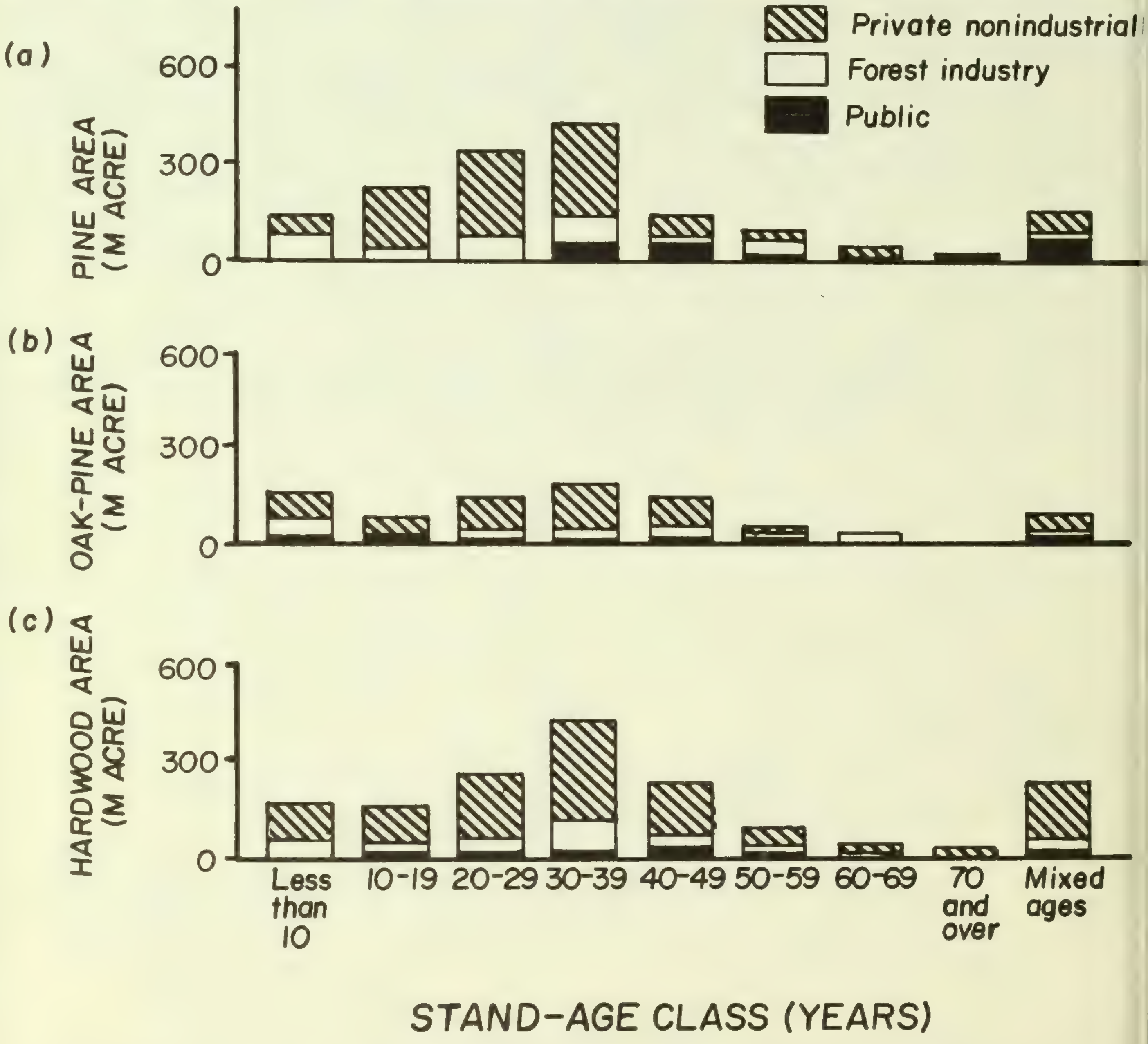

Figure 5. *Area of commercial Forest Land in pine, oak pine, and hardwood forest types, by stand-age class and ownership class, Central Region, 1977.*

technological advances because growth and removals are nearly equal.

The forest industry in the Southwest Region harvested 60% more pine sawtimber from company lands than was grown in 1976 (Murphy 1978), and the high proportion of private, nonindustrial lands must contribute an increasing share of future requirements. Favorable conditions for improving forest management on private, nonindustrial lands will result from the increased competition for softwood in the Region.

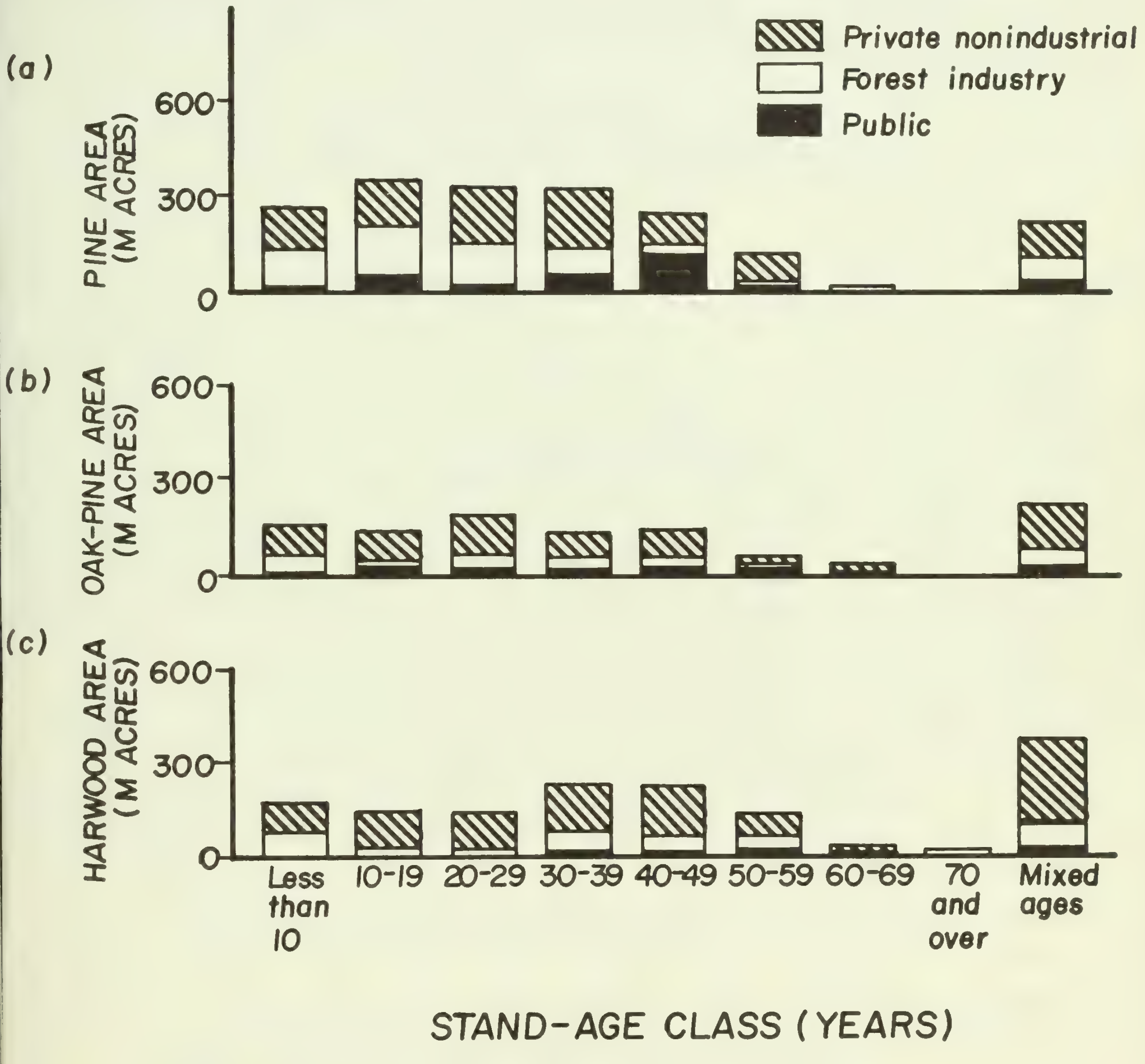

Figure 6. Area of commercial Forest Land in pine, oak-pine, and hardwood forest types, by stand-age class and ownership class, South Region. 1977

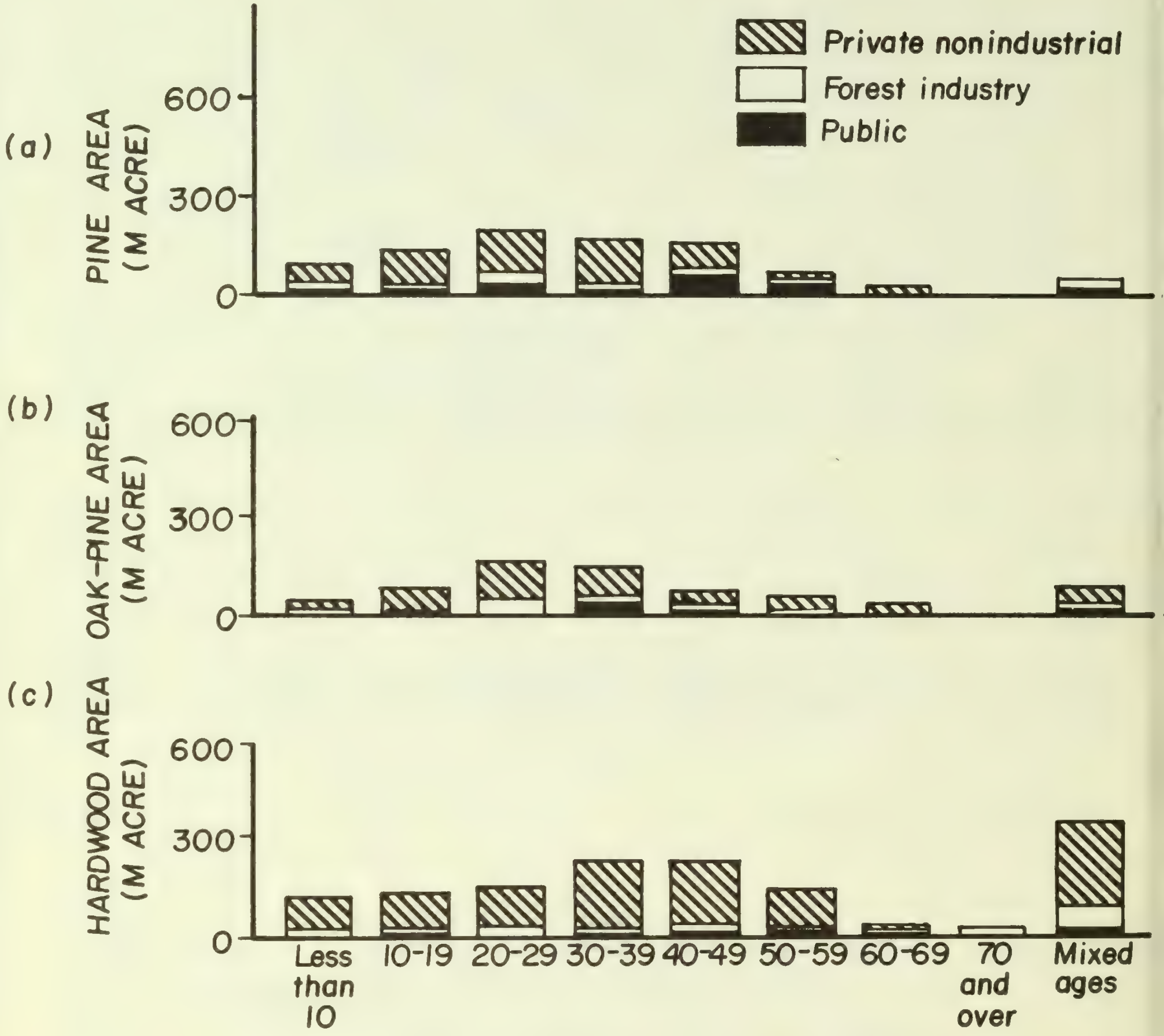

Figure 7. Area of commercial Forest Land in pine, oak pine, and hardwood forest types, by stand-age class and ownership class, Southwest Region, 1977.

Stand-Age Distribution by Site

Site quality determines the ability of an area to respond to forest management practices in both the short run and the long run. Distributions of acres of forest land by stand-age class for four forest types and three ownership groups are presented in Tables 1 and 2 for high and medium sites. High sites are considered to be capable of producing 120 cubic feet of wood per acre per year in fully stocked natural stands. Medium sites are capable of producing between 50 and 120 cubic feet. Low sites were not examined because fewer than 350 M acres in Mississippi were classed in the 1977 Forest Survey as incapable of producing at least 50 cubic feet of wood per acre per year.

Private, nonindustrial forests include 67% of the 3 MM acres classified as good site and 62% of the pine acreage on good sites. Only 5% of the private, nonindustrial pine area on good sites stocked in pine is in the less than 10-years age class while 31% is in the 30- to 39-years age class.

Industrial lands support a reasonably uniform age-class distribution of pine on medium sites, but private, nonindustrial lands do not (Table 2). However, both industrial and private, nonindustrial high-site lands support an unbalanced distribution of pine acres because of smaller acreages in the younger age classes (Table 1). More regeneration efforts need to be devoted to higher site lands. The better sites need a higher priority for harvesting and replanting because of their higher productive capacity.

Stand-Age Distribution of Volume

Average volumes of growing stock per acre on Mississippi's commercial forest land by ownership group, forest type and stand-age class are presented in Table 3. Growing stock levels of industrial and private, nonindustrial landowners are comparable for both pine and oak-pine forest types, but these groups are producing at only 60 and 56% of their productive potentials (Porterfield et al, 1978).

Total volume estimates were developed by adjusting average volume per acre by acreage. Estimated total volumes statewide are presented by stand-age classes for three ownership groups and four forest types (Table 4). Private, nonindustrial landowners control 59% of the estimated total pine volume.

An estimated 484.3 MMCF of pine were removed from Mississippi forests in 1976 (Murphy 1978). No significant shortfall in softwood supply is expected in the next 20 years, assuming the 1976 harvest level continues. However,

Table 1. Area of commercial forest land on good sites, by broad forest type and ownership group and by stand-age class, Mississippi, 1977.

Broad Forest Type and Ownership Class	All Classes	STAND-AGE-CLASS								
		10	10–19	20–29	30–39	40–49	50–59	60–69	70+	Mixed
	M ACRES									
PINE										
Public	158.1	–	7.0	–	40.0	52.6	12.8	16.3	5.6	23.8
Industry	180.4	12.9	23.8	37.5	51.8	–	37.2	–	–	17.2
PNI	549.6	28.8	102.7	150.7	168.1	41.7	11.3	–	6.6	39.7
Total	888.1	41.7	133.5	188.2	259.9	94.3	61.3	16.3	12.2	80.7
OAK-PINE										
Public	56.7	–	10.5	4.3	11.2	24.5	–	–	–	6.2
Industry	119.3	5.3	–	30.1	33.2	27.8	11.9	5.8	–	5.2
PNI	469.4	33.8	33.7	119.2	109.0	85.7	11.2	20.6	–	56.2
Total	645.4	39.1	44.2	153.6	153.4	138.0	23.1	26.4	–	67.6
UPLAND HWD.										
Public	38.2	–	5.2	5.7	–	10.9	10.8	–	–	5.6
Industry	96.8	23.7	12.3	18.5	21.6	6.3	–	–	–	14.4
PNI	447.9	59.1	45.9	66.6	108.5	62.1	19.9	25.1	–	60.7
Total	582.9	82.8	63.4	90.8	130.1	79.3	30.7	25.1	–	80.7
BOTTOMLAND HWD.										
Public	73.2	–	–	21.4	9.6	6.2	18.8	5.6	–	11.6
Industry	249.9	29.5	12.9	42.2	54.9	36.1	24.2	6.7	–	43.4
PNI	607.9	19.0	30.0	83.7	121.5	140.4	59.2	10.9	7.2	136.0
Total	931.0	48.5	42.9	147.3	186.0	182.7	102.2	23.2	7.2	191.0

younger stands with smaller stems will be harvested, and industry needs to prepare for processing smaller raw material.

Any substantial increases in short-run consumption will have to be achieved by increasing per acre output. Per acre outputs can be augumented through better use and through improved management and technology.

The pulpwood industry in the South is an example of how timber supply can be increased effectively by technological improvements. Production can be increased 10 to 15% by using tree-length harvesting and log transportation systems (Porterfield and von Segen 1976). Short-run availability also may be increased by per acre production gains obtained through thinning and timber stand improvement.

Table 2. Area of commercial forest land on medium sites, by broad forest type and ownership class and by stand-age class, Mississippi, 1977.

Broad Forest Type and Ownership Class	All Classes	10	10–19	20–29	30–39	40–49	50–59	60–69	70+	MIXED
					STAND-AGE CLASS					
	M ACRES									
PINE										
Public	610.5	22.0	63.3	80.4	102.7	194.8	53.1	9.6	5.4	79.2
Industry	1,123.0	221.5	218.1	284.3	177.9	79.5	44.8	-	-	96.9
PNI	2,531.5	241.8	466.3	635.9	570.3	281.3	125.1	13.2	7.0	190.6
Total	4,265.0	485.3	747.7	1,000.6	850.9	555.6	223.0	22.8	12.4	366.7
OAK-PINE										
Public	300.5	17.9	38.7	38.2	59.3	34.7	23.6	11.7	5.6	70.8
Industry	523.5	149.1	45.1	78.3	83.9	71.2	17.3	7.0	11.2	60.4
PNI	1,768.0	196.8	305.5	370.6	336.9	168.7	96.8	5.7	-	287.0
Total	2,592.0	363.8	389.3	487.1	480.1	274.6	137.7	24.4	16.8	418.2
UPLAND HWD.										
Public	164.8	17.9	17.8	6.2	29.8	48.9	-	5.6	16.7	21.9
Industry	466.1	123.7	69.1	49.4	62.9	17.9	58.7	9.8	-	74.6
PNI	3,021.7	338.3	450.4	451.3	661.4	340.6	201.7	35.7	10.7	531.6
Total	3,652.6	479.9	537.3	506.9	754.1	407.4	260.4	51.1	27.4	628.1
BOTTOMLAND HWD.										
Public	190.7	-	10.6	16.4	48.4	34.7	33.9	18.0	-	28.7
Industry	478.3	23.9	27.4	29.7	124.9	75.7	83.6	11.7	11.1	90.3
PNI	1,888.9	87.5	96.1	306.1	513.5	315.6	178.3	15.2	29.6	347.0
Total	2,557.9	111.4	134.1	352.2	686.8	426.0	295.8	44.9	40.7	466.0

Table 3. Average volume on commercial forest land, by broad ownership class and forest type and by stand-age class, Mississippi, 1977.

Broad Ownership and Forest Type	All Classes	10	10–19	20–29	30–39	40–49	50–59	60–69	70+	Mixed
					STAND-AGE CLASS					
	CUBIC FEET PER ACRE									
PUBLIC										
Pine	1918	232	626	1519	2179	2209	2343	2297	3073	2017
Oak-Pine	1457	693	835	927	1482	1971	1815	2197	2425	1646
Upland Hwd.	1390	361	888	1731	1234	1611	1858	2802	2165	1051
Bottomland Hwd.	1794	-	649	1585	1817	1807	1979	2434	-	1662
INDUSTRY										
Pine	1293	148	957	1552	1768	1941	2391	-	-	1424
Oak-Pine	1079	157	599	1108	1570	1786	2491	1765	932	1014
Upland Hwd.	878	182	408	682	1539	1240	1580	1076	-	1415
Bottomland Hwd	1569	329	1059	968	1484	2006	1914	2109	2086	1866
PRIVATE NONIND.										
Pine	1435	565	972	1508	1778	1901	1764	1653	1900	1410
Oak-Pine	1118	292	608	1068	1460	1624	1465	2948	-	1186
Upland Hwd.	1022	337	599	884	1248	1410	1537	1733	1984	1101
Bottomland Hwd	1399	278	501	1273	1525	1665	1685	1925	1349	1441

Table 4. Total volume on commercial forest land, by broad ownership class and forest type and by stand-age class, Mississippi, 1977.

Broad Ownership class and forest type	All Classes	10	10–19	20–29	30–39	40–49	50–59	60–69	70+	Mixed
	MMCF									
PUBLIC										
Pine	1,511.0	6.6	47.7	131.0	311.0	558.1	154.4	71.6	22.8	207.8
Oak-Pine	522.8	12.4	41.1	39.4	104.5	116.7	42.8	25.7	13.5	126.7
Upland Hwd.	281.4	6.5	20.5	20.6	36.8	96.2	20.1	15.6	36.2	28.9
Bottomland Hwd.	465.1	-	6.9	59.8	105.4	74.0	104.3	57.3	-	57.4
Total	2,780.3	25.5	116.2	250.8	557.7	845.0	321.6	170.2	72.5	420.8
INDUSTRY										
Pine	1,716.4	34.8	242.4	507.7	406.0	154.4	208.6	-	-	162.5
Oak-Pine	742.9	25.1	31.2	132.8	192.3	176.8	73.0	22.4	10.4	78.9
Upland Hwd.	498.2	26.9	35.7	46.3	130.0	30.0	92.8	10.6	-	125.9
Bottomland Hwd	1,097.5	17.6	42.7	59.3	259.0	212.7	195.1	38.7	23.1	249.3
Total	4,055.0	104.4	352.0	746.1	987.3	573.9	569.5	71.7	33.5	616.6
PRIVATE NONIND.										
Pine	4,476.2	115.5	558.8	1,222.9	1,323.5	614.1	253.6	21.8	25.8	340.2
Oak-Pine	2,545.8	67.3	213.3	534.3	651.1	421.7	167.2	77.6	-	413.3
Upland Hwd.	3,634.6	140.0	300.2	462.6	1,008.9	587.3	350.6	105.5	21.2	658.3
Bottomland Hwd	3,441.7	24.2	69.0	482.2	927.8	750.1	400.1	50.2	49.6	688.5
Total	14,098.3	347.0	1,141.3	2,702.0	3,911.3	2,373.2	1,171.5	255.1	96.6	2,100.3

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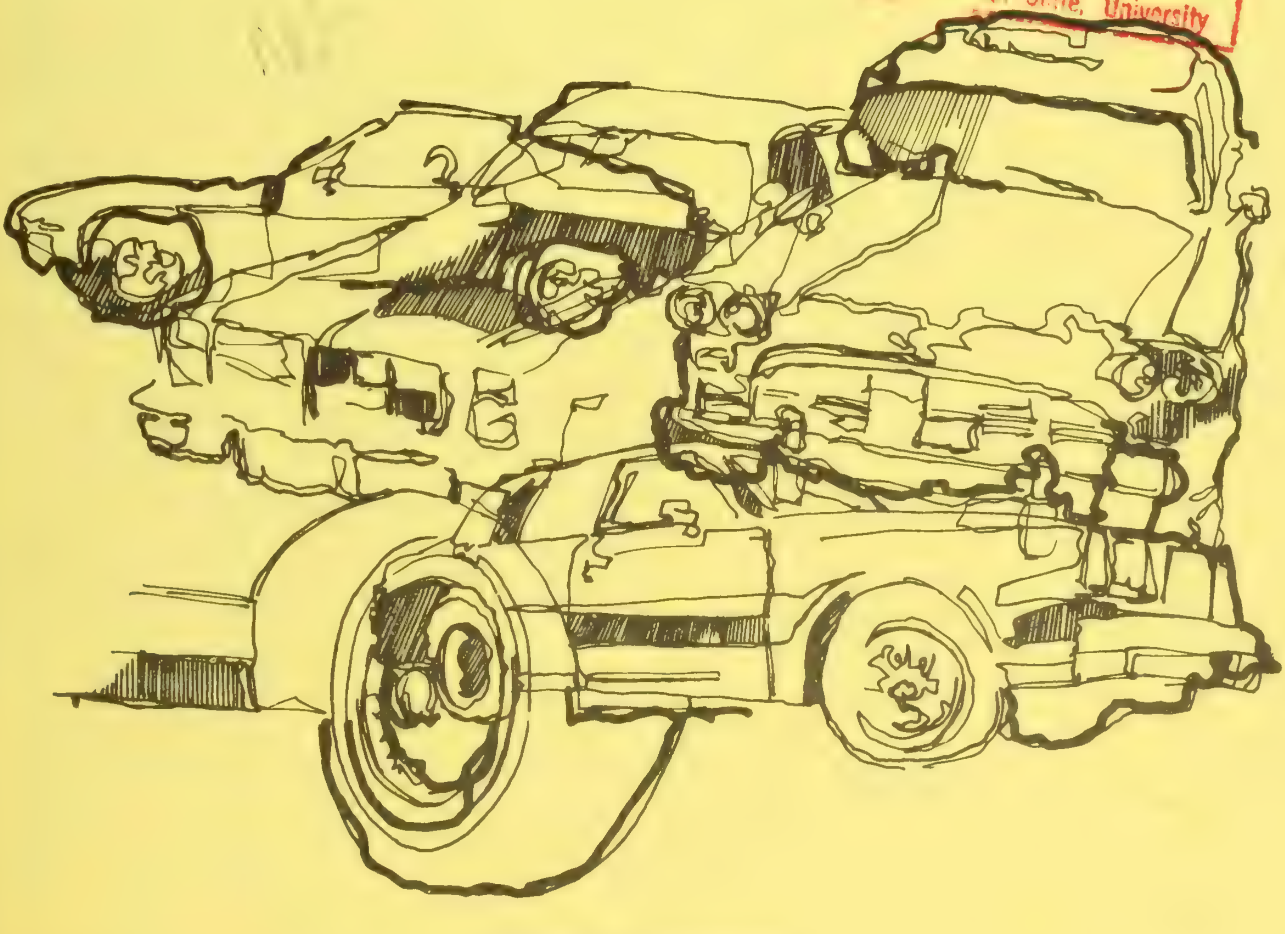

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Changes in Commuting in Mississippi from 1960 to 1970

Communting to work by automobile is a widely observed phenomenon in the United States. The daily exchange of workers between city and suburb and between rural and urban areas involves distances as great as the span of several counties, with commuting sometimes exceeding two hours one way.[1]

Employed Mississippians have commuted to work from their county of residence to other Mississippi counties and to adjoining states for many years. The 1960 and 1970 national censuses documented the volume and direction of intercounty journeys to work. This publication presents a summary of these data for Mississippi. It includes sets of tables and maps that depict and compare patterns and volumes of intercounty commuting for 13 designated commuting areas in the state in 1960 and 1970.

The purpose of this publication is to present the commuting pattern of Mississippi workers in 1970, with highlights of changes in the pattern since 1960. The information is presented as an aid to individuals and groups in assessing more fully the dynamics and interdependence of economic change in and around their local areas and to provide a background for future studies of commuting and its impact on rural and industrial development.

Statewide Commuting Patterns

Employment growth in Mississippi between 1960 and 1970 incorporated a disproportionate increase in numbers of intercounty commuters. Commuters increased by 76% while numbers of employed residents increased by only 11.4%, leaving the number of non-commuting workers essentially unchanged (Table A).[2]

TABLE A. CHANGE IN NUMBERS OF COMMUTERS CROSSING STATE AND COUNTY LINES ON THEIR JOURNEY TO WORK, MISSISSIPPI RESIDENTS AND RESIDENTS OF ADJOINING STATES, 1960 AND 1970.

Type of Worker	Number Working		
	1970	1960	Percent Change
Mississippi Residents Working			
Total	743,100	666,712	11.4
Inside County of Residence	574,921	587,961	-2.2*
Outside County of Residence	100,627	57,089	76.3
In Place not Reported	58,552	21,662	170.3*
Working Outside State in			
Alabama	3,045	2,560	18.9
Arkansas	234	209	12.0
Louisiana	5,831	3,812	53.0
Tennessee	9,867	3,426	188.0
Total	18,977	10,007	89.6
Working in Mississippi, but			
Resident of Alabama	5,220	2,567	103.4
Resident of Arkansas	468	248	88.7
Resident of Louisiana	4,413	2,351	87.7
Resident of Tennessee	3,529	1,622	177.6
Total	13,630	6,788	100.7

* If all the non-reported workers were arbitrarily assigned to the "work inside county of residence" category, that group would show an increase of 7.7 percent rather than the -2.2 decrease shown, but compared to the increase of 76.3% for commuting workers it still would be unimpressive.

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[1] *James N. Morgan, "A Note on the Time Spent on the Journey to Work," Demography, Vol. 4, No. 1 (1967), pp. 360-2.*

[2] *No effort was made to assign commuting or non-commuting status to the employed residents for whom place-of-work data were not available. Therefore, the volume of commuting undoubtedly exceeds that presented here. Nevertheless, it is felt that the data do depict major changes in commuting patterns in the state.*

Exchange of commuters with adjoining states almost doubled in both directions between 1960 and 1970, but the increased flow into the state was slightly ahead of the out-of-state flow---for each out-of-state resident working in Mississippi in 1960, 1.47 Mississippians were working in a neighboring state. This ratio had decreased to 1.39 by 1970, a change that incorporated proportionately more worker exports to Tennessee and more worker imports from Louisiana, Alabama and Arkansas.

Mississippi exchanged the largest number of workers with Tennessee, with commuting between the two states totaling more than 13,000 in 1970. The number of Mississippians commuting to Tennessee to work in 1970 was almost three times the number doing so in 1960, but the number going in the opposite direction only doubled. The worker exchange ratio (the number of Mississippians working in Tennessee per Tennessean working in Mississippi) was 2.79 in 1970 and 2.1 in 1960, indicating a decrease in the relative economic strength of the Mississippi counties that border Tennessee.

Exchanges with Louisiana totaled more than 10,000 in 1970, and the exchange ratios (1.32 in 1970 and 1.62 in 1960) indicate a declining and relatively low level of economic dominance of Louisiana over southwest Mississippi.

The number of workers exchanged with Alabama was more than 8,000 in 1970---an increase of about 3,000 over 1960, but this resulted in a decrease in the exchange ratio from parity in the earlier decade to one of economic dominance by Mississippi in 1970 (1.0 in 1960 and .58 in 1970).

Worker exchange with Arkansas was minimal in both census counts, and imports into Mississippi were larger than exports.

County Typology

Changes in numbers of employed residents and in the number of commuters per 100 non-commuters from 1960 to 1970 were used to set up a commuting typology of counties to facilitate summarization of general commuting tendencies in Mississippi and to establish the relation of commuting tendencies to employment growth. Counties were assigned to one of four groups (Type I, Type II, Type III or Type IV) with characteristics as follow:

TABLE B. COMMUTING TRENDS TYPOLOGY, MISSISSIPPI COUNTIES

County	Percent Change in Number of Employed Residents From 1960 to 1970	Change in Number of Commuters per 100 Non-Commuters From 1960 to 1970	Rank of Number of Commuters per 100 Non-Commuters 1970
Type I	+	-	
Rankin	43.2	- 52.1	62
Hancock	37.4	- 2.6	20
Lee	24.9	- 1.3	69
Hinds	15.8	- 2.7	73
Oktibbeha	14.8	- 1.7	64
Forrest	14.7	- 2.1	65
Grenada	12.1	- 1.0	76
Warren	8.5	- 2.3	82
Neshoba	5.5	- 5.7	48
Lauderdale	5.0	- 2.5	80
Clay	2.1	- 1.0	63
Attala	1.2	- 2.0	57
Lafayette	1.2	- 1.4	60
Type II	+	+	
Jackson	68.8	3.4	53
De Soto	65.4	107.6	1
Stone	34.9	7.6	27
Pearl River	31.0	27.1	15
Prentiss	26.2	9.2	38
George	19.9	21.5	7
Harrison	17.4	2.9	72
Greene	17.2	2.1	9
Union	16.2	4.4	39
Itawamba	16.1	23.1	6
Pontotoc	15.5	19.5	13
Wayne	14.4	1.8	42
Lamar	13.3	39.5	3
Lowndes	13.0	1.2	78
Tippah	9.6	9.1	52
Covington	8.6	15.2	19
Tishomingo	8.3	14.1	26
Lawrence	7.8	7.2	30
Simpson	7.2	1.5	33
Yalobusha	5.6	13.5	34
Scott	5.6	6.0	49
Monroe	5.3	2.5	45
Tate	4.6	17.5	31
Montgomery	4.3	10.3	43
Jones	4.0	2.9	59
Newton	4.0	8.3	35
Perry	3.9	26.0	5
Leake	3.8	7.5	32
Lincoln	3.4	4.9	41
Benton	1.3	22.2	12
Jasper	1.2	34.5	4
Chickasaw	.8	8.5	51
Choctaw	.6	22.4	8
Clarke	.4	11.5	29
Type III	-	+	
Jefferson Davis	- .3	20.6	25
Calhoun	- .4	5.1	47
Winston	- 1.0	8.1	46
Marshall	- 1.3	24.0	22
Webster	- 1.4	20.0	23
Panola	- 3.9	7.4	50
Marion	- 4.4	3.2	54
Alcorn	- 5.2	1.9	66
Claiborne	- 6.8	15.0	40
Bolivar	- 7.8	.6	70
Copiah	- 10.4	8.4	37
Wilkinson	- 10.6	16.6	18
Walthall	- 10.7	25.6	16
Franklin	- 11.0	8.3	17
Smith	- 12.3	13.1	28
Madison	- 12.3	20.1	21
Carroll	- 12.4	67.9	2
Amite	- 14.9	20.5	24
Noxubee	- 18.0	3.6	55
Holmes	- 20.0	1.7	58
Issaquena	- 20.2	31.4	10
Sunflower	- 23.7	4.4	56
Jefferson	- 24.8	26.5	11
Kemper	- 25.1	29.9	14
Sharkey	- 31.1	3.2	61
Tallahatchie	- 34.6	7.0	44
Tunica	- 45.0	2.8	75
Quitman	- 72.4	15.3	36
Type IV	-	-	
Adams	- 3.8	- 2.0	74
Pike	- 9.4	- 2.9	67
Leflore	- 11.9	- 1.6	77
Yazoo	- 12.4	- 1.4	68
Washington	- 16.6	- 2.2	81
Coahoma	- 20.7	- 0.1	79
Humphreys	- 24.9	- 0.4	71

Source: Computed from date in Area Tables 1A and 1B - 13A and 13B.

Type I---counties with an increase in number of employed residents and a decrease in number of commuters per 100 non-commuters;

Type II---counties with an increase in number of employed residents and in number of commuters per 100 non-commuters;

Type III---counties with a decrease in number of employed residents and an increase in number of commuters per 100 non-commuters;

Type IV---counties with a decrease in number of employed residents and in number of commuters per 100 non-commuters (Table B).

Commuting Patterns by Designated Areas

Thirteen commuting areas were delineated by plotting commuter streams on county outline maps and identifying their major confluences. Commuters from Mississippi counties streamed out in several directions and some counties seem to be parts of more than one commuting hinterland. These counties were assigned to two commuting areas (Table C), and the overlaps are described in the discussion of the separate areas. Four of the areas were named after SMSA (Standard Metropolitan Statistical Area) cities (Areas, 1, 4, 5 and 13), eight after the dominant (hub or 'nodal'[3]) county or counties they contain (Areas 2, 3, 6, 7, 8, 9, 11 and 12) and one after the area name of its three central counties (Area 10). Commuting data for each area are presented in two tables (Tables 1A and 1B - 13A and 13B) two maps (Figures 1A and 1B - 13A and 13B).

The first table for each area reports the number of residents who were employed, the number of non-commuters, the number of commuters and the number of employed residents for whom place-of-work data were not available. The second table for each area reports the number of commuters per 100 non-commuters.

The first map for each area presents commuting patterns for 1970, and the second map presents commuting patterns for 1960. Commuter streams are depicted by arrows, with the points showing

TABLE C. COMMUTING AREA LOCATIONS OF MISSISSIPPI COUNTIES

County	Area No.	County	Area No.
Adams	6	Leflore	2
Alcorn	8	Lincoln	7
Amite	6, 7	Lowndes	10
Attala	4	Madison	4, 5
Benton	8	Marion	7, 12
Bolivar	2	Marshall	1, 8
Calhoun	3	Monroe	9, 10
Carroll	2, 3	Montgomery	3
Chickasaw	3, 9	Neshoba	11
Choctaw	3, 10	Newton	11
Claiborne	4, 6	Noxubee	10
Clarke	11, 12	Oktibbeha	10
Clay	10	Panola	1
Coahoma	2	Pearl River	13
Copiah	5, 7	Perry	12
Covington	12	Pike	7
De Soto	1	Pontotoc	9
Forrest	12	Prentiss	8, 9
Franklin	6, 7	Quitman	1
George	13	Rankin	5
Greene	12	Scott	5, 11
Grenada	2, 3	Sharkey	2, 4
Hancock	13	Simpson	5, 12
Harrison	13	Smith	5, 12
Hinds	4, 5	Stone	13
Holmes	2, 4	Sunflower	2
Humphreys	2	Tallahatchie	2, 3
Issaquena	2, 4	Tate	1
Itawamba	9	Tippah	8
Jackson	13	Tishomingo	8
Jasper	11, 12	Tunica	1
Jefferson	6	Union	8, 9
Jefferson Davis	7, 12	Walthall	7
Jones	12	Warren	4
Kemper	11	Washington	2
Lafayette	1, 3	Wayne	12
Lamar	12	Webster	3, 10
Lauderdale	11	Wilkinson	6
Lawrence	7	Winston	10, 11
Leake	5, 11	Yalobusha	3
Lee	9	Yazoo	2, 4

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[3] *The term "node" (or "nodal" area or county) was used by Bogue in developing his functional area concept (as opposed to homogeneous regions such as state economic areas) and refers to the center of exchange in an economically heterogeneous area---in this case a county attracting sizable streams of in-commuters but sending out few workers to other counties. See Donald J. Bogue, Principles of Demography,* New York: John Wiley and Sons, Inc., 1969, pp. 464-5.

the place of work of commuters and the base showing the number of commuters by county of origin. Commuter streams of 20 or less were omitted from counties within an area but were included for counties outside an area when it appeared that doing so would facilitate comparisons. Reference to the maps for both areas is necessary to obtain a complete description of the commuting pattern of counties assigned to two areas.

Variations and Similarities---Most commuting in the state in 1970 occurred between adjoining counties as local exchanges. Commuting across more than one county boundary appeared to have decreased except for the travel of workers to SMSA cities or large commercial centers.

Each commuting area contains at least one hub (or nodal) county that attracted a disproportionate number of commuting workers. Commuter to non-commuter ratios decreased from 1960 to 1970 in 70% of the nodal counties, indicating employment of larger proportions of their own residents in addition to employment of more workers from surrounding counties. Therefore, economic development of such counties may have been greater than their population growth suggests.

Numbers of employed residents and numbers of commuters in most counties in the eastern one half of the state increased from 1960 to 1970. Most counties in the western one half of the state experienced a decrease in numbers of employed residents and in numbers of commuters.

The largest commuter streams were associated with SMSA "nodes"[4] and large urban centers, and commuters to these centers in 1970 often were more likely to be urban than rural residents, suggesting that counties adjoining larger urban centers tend to become "bedroom" counties for such centers. However, commuting in 1970 generally was more characteristic of rural than of urban populations. Therefore, commuting appeared to be associated with two types of worker distribution---one accommodating the influx of workers to urban fringes, the other providing a means for rural people to find employment without having to move from their home communities.

TABLE 1A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 1 (Memphis, SMSA), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

		Commuting Status			
		Non-Commuters	Commuters		
Counties	Number of Employed Residents*		Destination Given	Destination Not Given	Unaccounted for/or Not Reported
			1970		
De Soto	11,474	4,148	6,020	284	1,022
Lafayette	7,947	6,839	661	103	344
Marshall	6,453	4,239	1,539	149	526
Panola	8,277	6,606	1,020	143	508
Quitman	4,041	3,078	637	137	189
Tate	5,691	3,630	1,126	76	859
Tunica	2,695	2,330	123	4	238
			1960		
De Soto	6,936	4,620	1,869	182	265
Lafayette	6,666	5,664	377	335	290
Marshall	6,535	5,261	549	280	445
Panola	8,610	7,171	466	262	711
Quitman	5,580	4,217	331	87	945
Tate	5,443	4,299	486	184	474
Tunica	4,900	3,973	77	30	820

Sources: U. S. Bureau of the Census, Summary Tape of the 1970, U. S. Census Population (Mississippi State, Mississippi: Summary Tape Processing Center), Fourth Count, Tab 35; 1970 Census of Population, Report PC (1)-C26 (Washington, D. C.: USGPO), Table 123; 1960. Report PC (1)-26C, Table 83.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 1B. COMMUTERS* PER 100 NON-COMMUTERS AREA 1 (Memphis SMSA), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

	1970			1960
Counties	Total	Urban	Rural	Total
De Soto	152.0	587.0	97.5	44.4
Lafayette	11.2	6.7	18.1	12.6
Marshall	39.8	5.2	60.9	15.8
Panola	17.6	11.8	18.9	10.2
Quitman	25.2	7.5	30.2	9.9
Tate	33.1	16.5	41.7	15.6
Tunica	5.5	---	5.5	2.7

Source: Computed from Table 1A and comparable Census data for rural/urban areas, 1970.

*Computations do not include employed residents for whom place-of-work data were not available. However, it is assumed that the missing data were distributed uniformly between commuters and non-commuters and that their exclusion did not affect the accuracy of described commuting patterns appreciably.

---

[4] *See footnote 3.*

Commuting Area 1: Memphis SMSA

The number of commuters from each county was larger in 1970 than in 1960 (Table 1A), but, despite the increase in commuting only three counties (DeSoto, Lafayette and Tate) experienced increases in the number of employed residents. The number of commuters per 100 non-commuters(Table 1B) decreased in Lafayette County (Type I) but increased in DeSoto and Tate Counties (Type II) and in Marshall, Panola, Quitman and Tunica Counties (Type III), with DeSoto having the highest commuter to non-commuter ratio of any county in the state in 1970.[5] Commuter to non-commuter ratios were higher for rural than for urban residents in all counties except DeSoto.

Travel of workers to jobs in Shelby County, Tennessee, dominated the commuter streams of the area in 1970 and 1960 (Figures 1A and 1B). Commuter interchange among the counties in the area increased from 1960 to 1970, and commuting by area residents to jobs in other Mississippi counties decreased relative to commuting into the area by residents of other Mississippi counties.

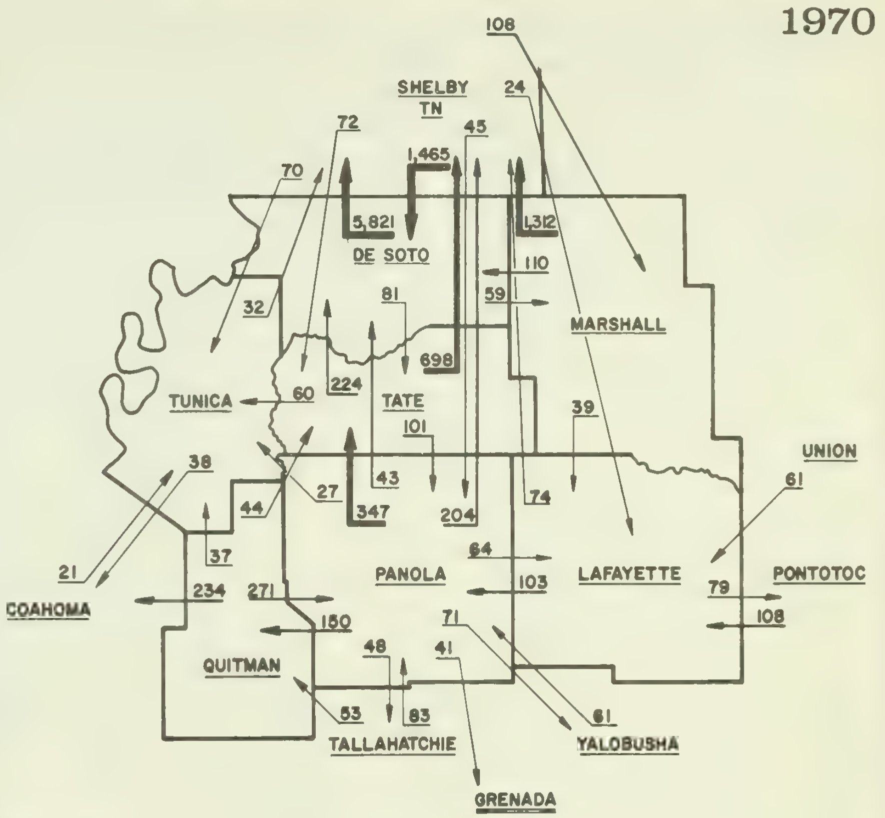
1970
108
SHELBY TN
24
72
45
1,465
70
5,821
1,312
DE SOTO
110
32
81
59
MARSHALL
698
TUNICA
60
224
TATE
39
101
UNION
38
61
43
27
74
347
204
44
64
37
PANOLA
LAFAYETTE
21
103
PONTOTOC
234
271
79
COAHOMA
150
108
71
48
41
QUITMAN
53
83
61
TALLAHATCHIE
YALOBUSHA
GRENADA

Figure 1A

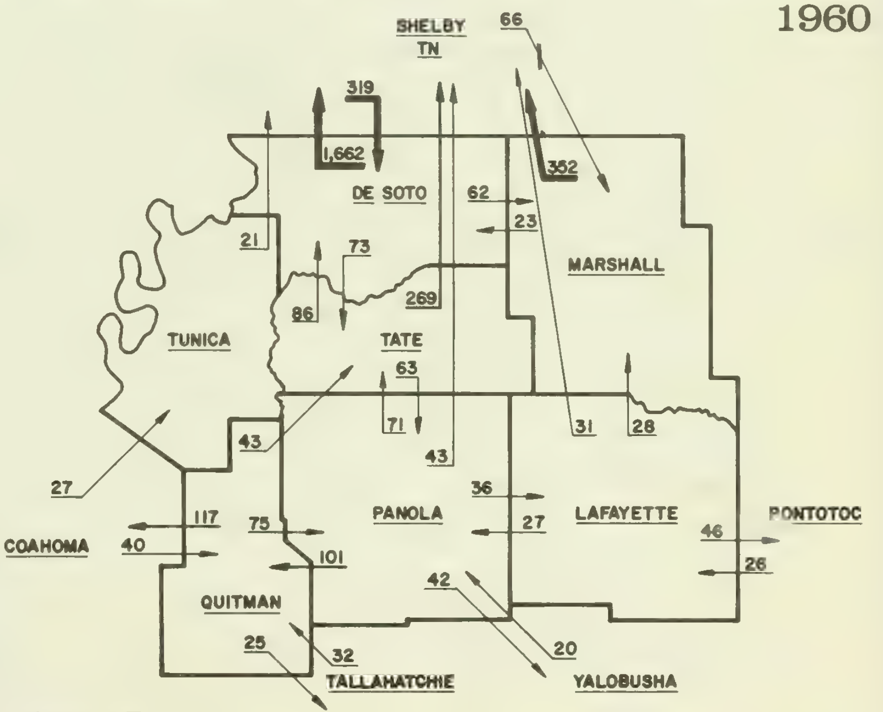
1960
SHELBY TN
66
319
1,662
352
DE SOTO
62
23
21
73
MARSHALL
269
86
TUNICA
TATE
63
71
31
28
43
43
27
36
PANOLA
LAFAYETTE
117
75
27
PONTOTOC
COAHOMA
40
46
101
26
42
QUITMAN
25
32
20
TALLAHATCHIE
YALOBUSHA

Figure 1B

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[5] *A decrease in the commuter to non-commuter ratio does not imply that the number of residents commuting to other counties necessarily decreased.*

Commuting Area 2: Bolivar, Leflore and Washington Counties

Commuting from two of the Type III counties (Bolivar and Holmes) decreased from 1960 to 1970 (Table 2A), and Bolivar County attained the status of a commuting hub as indicated by commuting streams (Figures 2A and 2B) and by the low commuter to non-commuter ratio in 1970 (Table 2B). Numbers commuting from the other Type III counties (Carroll, Issaquena, Sunflower and Tallahatchie) increased even though the number of employed residents in each county decreased.

TABLE 2A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 2, (Bolivar, Leflore, Washington Counties), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status			
		Non-Commuters	Commuters		Unaccounted for/or Not Reported
			Destination Given	Destination Not Given	
		1970			
Bolivar	13,942	11,829	598	225	1,290
Carroll	2,822	1,333	1,228	52	209
Coahoma	11,018	10,009	293	166	550
Grenada	7,122	6,211	199	137	575
Holmes	5,967	4,679	419	117	752
Humphreys	3,951	3,472	221	8	250
Issaquena	749	470	252	---	27
Leflore	13,471	12,312	466	199	494
Sharkey	2,432	2,061	190	33	148
Sunflower	9,851	7,347	827	65	1,612
Tallahatchie	4,932	3,811	788	33	300
Washington	21,983	19,327	438	309	1,909
Yazoo	8,299	6,576	495	20	1,208
		1960			
Bolivar	15,119	12,625	527	385	1,682
Carroll	3,287	2,370	616	51	250
Coahoma	13,888	11,419	272	262	1,935
Grenada	6,351	5,725	274	93	259
Holmes	7,462	6,182	444	160	676
Humphreys	5,261	4,407	170	138	546
Issaquena	938	679	99	52	108
Leflore	15,285	12,760	360	532	1,633
Sharkey	3,527	2,481	105	84	857
Sunflower	12,914	10,288	492	295	1,839
Tallahatchie	7,539	4,990	373	350	1,826
Washington	26,352	23,005	670	729	1,948
Yazoo	9,475	8,306	293	473	402

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 2B. COMMUTERS* PER 100 NON-COMMUTERS AREA 2 (Bolivar, Leflore, Washington Counties), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970			1960
	Total	Urban	Rural	Total
Bolivar	7.0	7.2	6.7	6.4
Carroll	96.0	---	96.0	28.1
Coahoma	4.6	4.5	4.7	4.7
Grenada	5.4	5.2	5.7	6.4
Holmes	11.5	8.6	12.7	9.8
Humphreys	6.6	3.9	7.4	7.0
Issaquena	53.6	---	53.6	22.2
Leflore	5.4	4.0	7.9	7.0
Sharkey	10.8	---	10.8	7.6
Sunflower	12.1	9.6	13.8	7.7
Tallahatchie	21.5	5.6	25.7	14.5
Washington	3.9	3.7	4.5	6.1
Yazoo	7.8	4.6	10.4	9.2

Source: Computed from Table 2A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

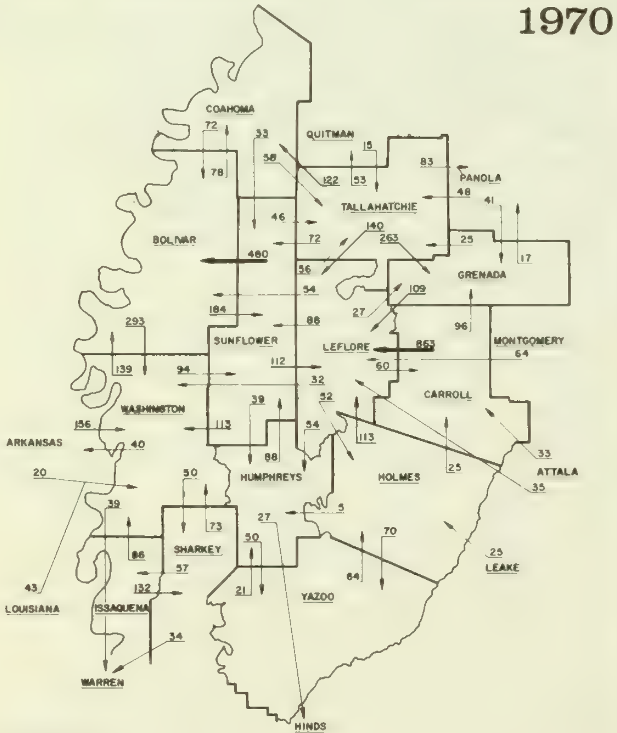
1970
COAHOMA
QUITMAN
PANOLA
TALLAHATCHIE
BOLIVAR
GRENADA
SUNFLOWER
LEFLORE
MONTGOMERY
CARROLL
WASHINGTON
ARKANSAS
HUMPHREYS
HOLMES
ATTALA
SHARKEY
YAZOO
LEAKE
LOUISIANA
ISSAQUENA
WARREN
HINDS
72
78
33
58
122
15
53
83
48
41
17
46
72
140
263
25
480
56
54
109
27
184
88
96
293
863
64
139
94
112
60
32
39
52
156
113
54
113
40
88
33
20
25
35
50
5
27
70
39
73
50
25
86
57
64
132
21
43
34

Figure 2A

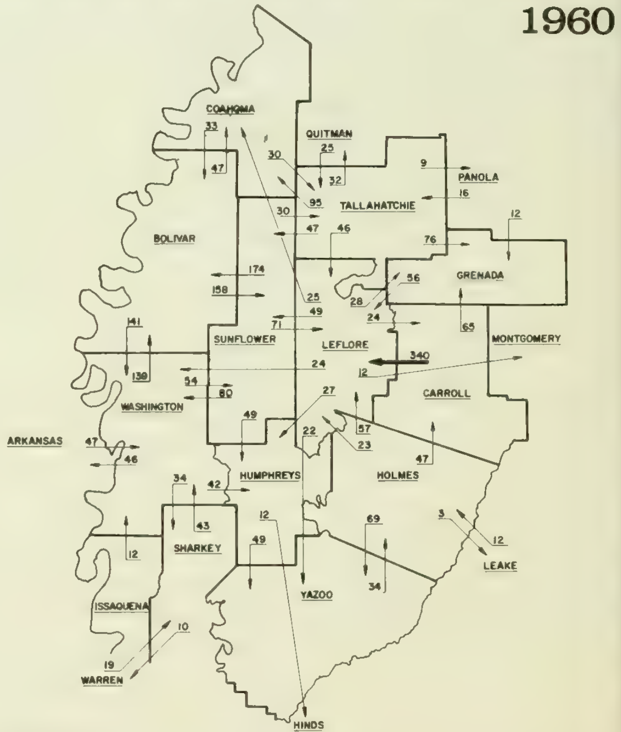
1960
COAHOMA
QUITMAN
PANOLA
TALLAHATCHIE
BOLIVAR
GRENADA
SUNFLOWER
LEFLORE
MONTGOMERY
CARROLL
WASHINGTON
ARKANSAS
HUMPHREYS
HOLMES
SHARKEY
YAZOO
LEAKE
ISSAQUENA
WARREN
HINDS
33
47
30
25
32
9
16
95
30
47
46
12
76
174
158
56
28
25
49
24
71
65
141
340
24
12
139
54
80
27
49
57
22
23
47
46
47
34
42
43
12
69
3
12
49
12
34
10
19

Figure 2B

Two Type IV counties (Leflore and Washington) met the criteria for commuting-hub status in 1970. The flow of commuters that brought commuting-hub status to Leflore County in 1960 more than doubled in the next decade. Washington County attained commuting-hub status in 1970 as a result of increases in numbers of commuters from other Mississippi counties and chiefly from Arkansas and Louisiana. Grenada County (Type I) retained commuting hub status (Figures 3A and 3B).

Commuting Area 3: Grenada County

The commuting hub status of Grenada County increased between 1960 and 1970 primarily because of the substantial increase in numbers of commuters from Calhoun, Montgomery and Yalobusha Counties (Figures 3A and 3B). Changes in the number of employed residents (Table 3A) and in the commuter to non-commuter ratios (Table 3B) indicate that Lafayette County is approaching commuter hub status.

The considerable increase in the exchange of workers among other counties in the area indicates that industrial development of the area has become more diffuse. The impact of commuting-hub counties in adjoining areas (Figures 2A, 2B, 9A, 9B, 10A and 10B) is shown by the increase in numbers of commuters to these areas from Area 3.

TABLE 3A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 3 (Grenada County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status: Non-Commuters	Commuting Status: Commuters: Destination Given	Commuting Status: Commuters: Destination Not Given	Unaccounted for/or Not Reported
			1970		
Calhoun	4,860	3,752	648	75	385
Carroll	2,882	1,333	1,228	52	209
Chickasaw	5,724	4,603	721	80	320
Choctaw	2,515	1,524	785	45	161
Grenada	7,122	6,211	199	137	575
Lafayette	7,947	6,839	661	103	344
Montgomery	4,277	3,221	524	177	355
Tallahatchie	4,932	3,811	788	33	300
Webster	3,220	2,298	876	38	8
Yalobusha	4,022	2,671	675	68	608
			1960		
Calhoun	4,880	4,015	300	270	295
Carroll	3,287	2,370	616	51	250
Chickasaw	5,678	4,922	370	70	316
Choctaw	2,501	1,731	476	79	215
Grenada	6,351	5,725	274	93	259
Lafayette	6,666	5,664	377	335	290
Montgomery	4,100	3,467	314	86	233
Tallahatchie	7,539	4,990	373	350	1,826
Webster	3,264	2,658	440	83	83
Yalobusha	3,809	3,135	290	159	225

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 3B. COMMUTERS* PER 100 NON-COMMUTERS AREA 3, (Grenada County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970 Total	1970 Urban	1970 Rural	1960 Total
Calhoun	19.3	---	19.3	14.2
Carroll	96.0	---	96.0	28.1
Chickasaw	17.4	11.5	21.7	9.0
Choctaw	54.5	---	54.5	32.1
Grenada	5.4	5.2	5.7	6.4
Lafayette	11.2	6.7	18.1	12.6
Montgomery	21.8	20.3	23.2	11.5
Tallahatchie	21.5	5.6	25.7	14.5
Webster	39.8	---	39.8	19.7
Yalobusha	27.8	10.2	33.7	14.3

Source: Computed from Table 3A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

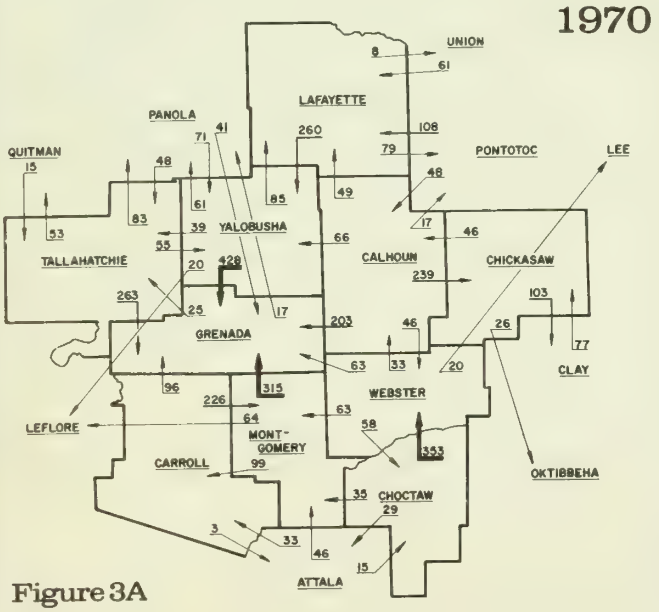
1970
UNION
8
61
LAFAYETTE
PANOLA
71
41
260
108
79
PONTOTOC
LEE
QUITMAN
15
48
48
83
53
61
85
49
17
39
55
YALOBUSHA
66
46
TALLAHATCHIE
20
428
CALHOUN
CHICKASAW
239
263
25
17
203
46
103
26
GRENADA
63
33
20
77
CLAY
96
315
WEBSTER
226
64
63
58
LEFLORE
MONT-GOMERY
353
CARROLL
99
OKTIBBEHA
35
CHOCTAW
29
3
33
46
15
ATTALA

Figure 3A

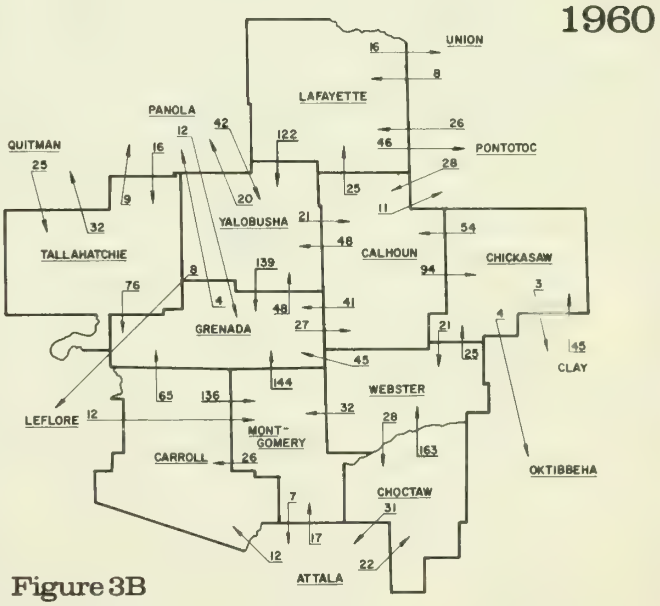
1960
16
UNION
8
LAFAYETTE
PANOLA
12
42
26
46
PONTOTOC
QUITMAN
25
16
122
28
25
9
32
20
11
YALOBUSHA
21
48
CALHOUN
54
CHICKASAW
TALLAHATCHIE
8
139
94
76
3
4
48
41
GRENADA
27
21
4
45
25
45
CLAY
144
WEBSTER
65
136
32
LEFLORE
12
28
MONT-GOMERY
163
CARROLL
26
OKTIBBEHA
7
CHOCTAW
31
12
17
22
ATTALA

Figure 3B

Commuting Area 4: Jackson SMSA---West and North

Numbers of commuters from Attala, Hinds and Warren Counties (Type I) decreased from 1960 to 1970, despite the increase in numbers of employed residents in each county (Table 4A). The result was that numbers of commuters per 100 non-commuters decreased in these counties (Table 4B) and in Holmes and Yazoo Counties (Type III).

Warren and Hinds counties are commuting hubs, and both contain nucleated industrial development. Commuting to Warren County from Hinds County was about four times that in the opposite direction and, while the volume of the streams more than doubled between 1960 and 1970, this relative difference persisted (Figures 4A and 4B). The largest flow of commuters into Hinds County in both years was from Madison County, and commuting to Hinds from Madison almost doubled from 1960 to 1970.

TABLE 4A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 4, (Jackson SMSA-West and North), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status: Non-Commuters	Commuting Status: Commuters: Destination Given	Commuting Status: Commuters: Destination Not Given	Commuting Status: Unaccounted for/or Not Reported
			1970		
Attala	6,188	5,124	518	72	474
Claiborne	2,765	2,046	429	59	231
Hinds	82,001	70,805	3,017	1,374	6,805
Holmes	5,967	4,679	419	117	752
Issaquena	749	470	252	---	27
Madison	8,882	6,065	2,406	94	317
Sharkey	2,432	2,061	190	33	148
Warren	15,784	14,277	284	167	996
Yazoo	8,299	6,576	495	20	1,208
			1960		
Attala	6,114	5,183	457	244	230
Claiborne	2,967	2,676	168	71	52
Hinds	70,827	63,279	3,210	2,450	1,888
Holmes	7,462	6,182	444	160	676
Issaquena	938	679	99	52	108
Madison	10,127	7,685	1,263	357	822
Sharkey	3,527	2,481	105	84	857
Warren	14,542	13,296	256	479	511
Yazoo	9,475	8,306	293	473	402

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 4B. COMMUTERS* PER 100 NON-COMMUTERS AREA 4, (Jackson SMSA-West and North), BY COUNTY, MISSISSIPPI, 1970 AND 1980.

Counties	1970 Total	1970 Urban	1970 Rural	1960 Total
Attala	11.5	6.3	15.8	13.5
Claiborne	23.9	11.5	31.4	8.9
Hinds	6.2	5.8	9.5	8.9
Holmes	11.5	8.6	12.7	9.8
Issaquena	53.6	---	53.6	22.2
Madison	41.2	24.1	57.6	21.1
Sharkey	10.8	---	10.8	7.6
Warren	3.2	3.0	3.3	5.5
Yazoo	7.8	4.6	10.4	9.2

Source: Computed from Table 4A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

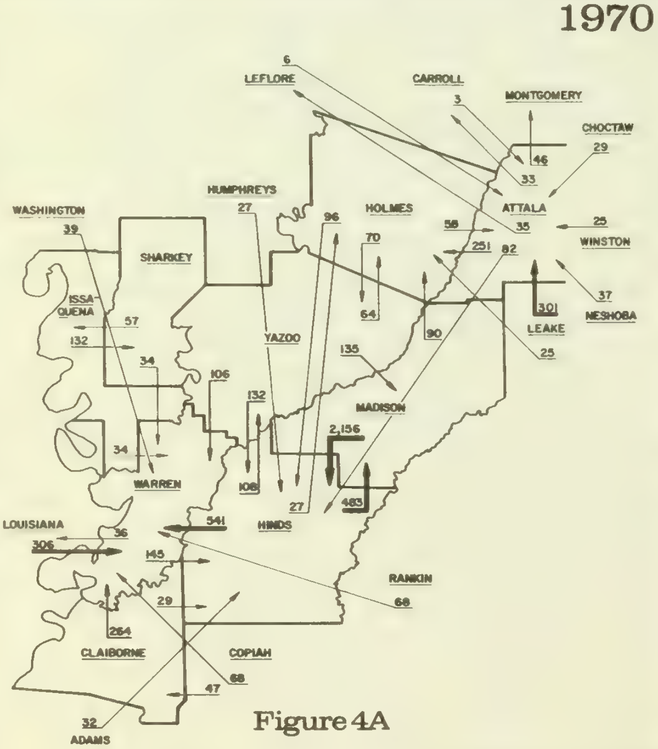
1970
LEFLORE
CARROLL
MONTGOMERY
CHOCTAW
HUMPHREYS
WASHINGTON
HOLMES
ATTALA
WINSTON
SHARKEY
ISSA-QUENA
YAZOO
LEAKE
NESHOBA
MADISON
WARREN
HINDS
LOUISIANA
RANKIN
CLAIBORNE
COPIAH
ADAMS
6
3
46
29
33
27
39
96
70
58
35
25
251
82
37
64
301
90
57
132
34
25
135
106
132
2,156
34
108
27
483
541
306
36
145
68
29
264
68
47
32

Figure 4A

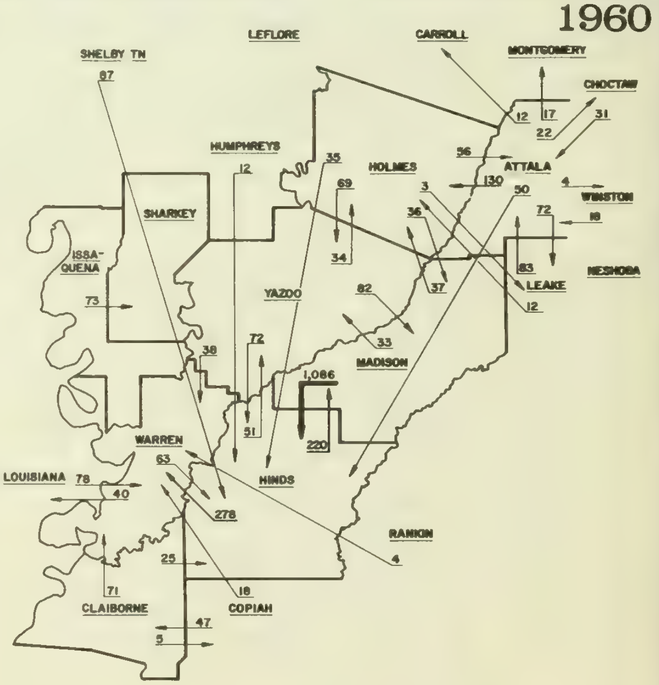
1960
LEFLORE
CARROLL
MONTGOMERY
SHELBY TN
CHOCTAW
HUMPHREYS
HOLMES
ATTALA
WINSTON
SHARKEY
ISSA-QUENA
NESHOBA
LEAKE
YAZOO
MADISON
WARREN
HINDS
LOUISIANA
RANKIN
CLAIBORNE
COPIAH
87
12
17
22
31
12
35
56
69
130
50
3
4
36
72
18
34
83
37
12
73
82
33
38
72
1,086
51
220
63
78
40
278
4
25
71
18
47
5

Figure 4B

Commuting Areas 5: Jackson SMSA--- East and South

The commuting pattern of the area in 1960 and 1970 was dominated by the interchange of commuters between Hinds (Type 1) and Rankin (Type I) and Hinds and Madison Counties (Table 5A). However, commuters per 100 non-commuters in 1960 and 1970, respectively, decreased from 8.9 to 6.2 in Hinds County and from 62.2 to only 10.1 in Rankin County (Table 5B) despite the relatively larger numbers of employed residents in Rankin County in 1970.

Numbers of commuters from counties in the periphery of the area increased much less dramatically from 1960 to 1970, and the increase in flow between them and Rankin, Madison or other contiguous counties was often greater than the increase to Hinds (Figures 5A and 5B). Commuting from outside the area increased over the ten years, primarily as the result of increases in commuting to Hinds County from Neshoba, Newton, Jones and Pike Counties (Figures 7A, 7B, 11A, 11B, 12A and 12B).

TABLE 5A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 5, (Jackson SMSA - East and South), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status: Non-Commuters	Commuters: Destination Given	Commuters: Destination Not Given	Unaccounted for/or Not Reported
		1970			
Copiah	7,471	5,714	1,261	173	323
Hinds	82,001	70,805	3,017	1,374	6,805
Leake	5,402	3,726	999	104	573
Madison	8,882	6,065	2,406	94	317
Rankin	15,081	7,020	6,781	287	993
Scott	7,032	5,313	783	171	765
Simpson	6,607	4,321	1,143	122	1,021
Smith	4,576	2,567	801	134	1,074
		1960			
Copiah	8,337	6,857	882	264	334
Hinds	70,827	63,279	3,210	2,450	1,888
Leake	5,206	4,062	688	208	248
Madison	10,127	7,685	1,263	357	822
Rankin	10,530	6,284	3,618	291	337
Scott	6,659	5,656	548	140	315
Simpson	6,161	4,701	1,104	201	155
Smith	5,217	4,141	850	114	112

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 5B. COMMUTERS* PER 100 NON-COMMUTERS AREA 5, (Jackson, SMSA-East and South), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970 Total	1970 Urban	1970 Rural	1960 Total
Copiah	25.1	18.0	29.6	16.7
Hinds	6.2	5.8	9.5	8.9
Leake	29.6	10.3	37.1	22.1
Madison	41.2	24.1	57.6	21.1
Rankin	10.1	15.1	82.0	62.2
Scott	18.0	10.4	23.3	12.2
Simpson	29.3	25.1	29.8	27.8
Smith	36.4	---	36.4	23.3

Source: Computed from Table 5A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

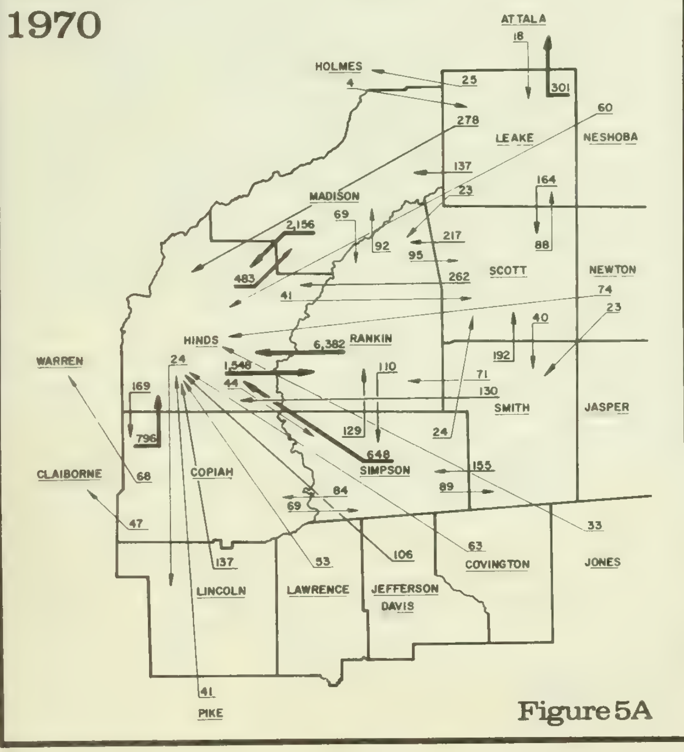
1970
ATTALA
HOLMES
MADISON
LEAKE
NESHOBA
SCOTT
NEWTON
HINDS
RANKIN
WARREN
SMITH
JASPER
CLAIBORNE
COPIAH
SIMPSON
COVINGTON
JONES
LINCOLN
LAWRENCE
JEFFERSON DAVIS
PIKE
18
301
4
25
278
60
137
23
164
88
69
2,156
92
95
217
483
262
41
74
23
40
6,382
192
1,546
44
110
71
130
169
24
796
129
648
24
155
68
89
84
69
47
137
53
106
63
33
41

Figure 5A

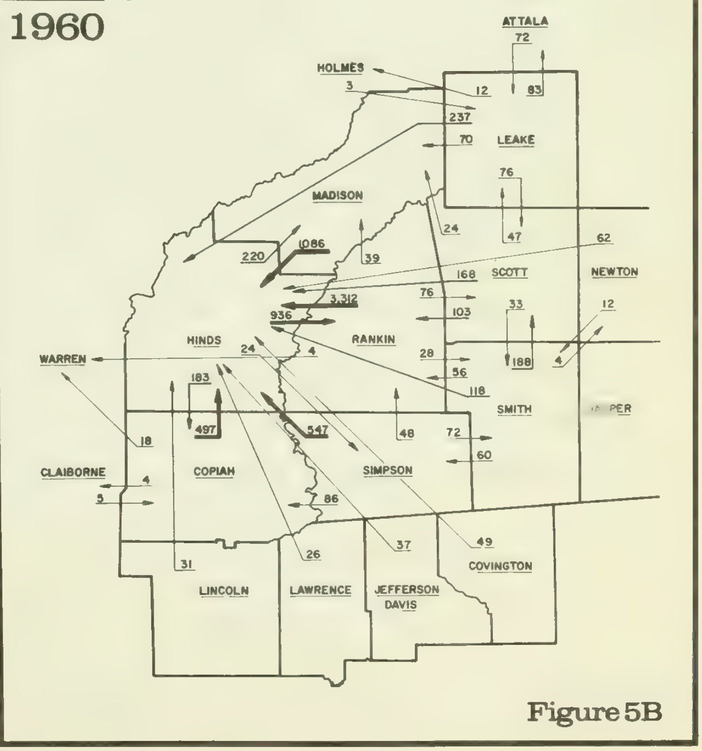
1960
ATTALA
HOLMES
LEAKE
MADISON
SCOTT
NEWTON
HINDS
RANKIN
WARREN
SMITH
JASPER
CLAIBORNE
COPIAH
SIMPSON
COVINGTON
LINCOLN
LAWRENCE
JEFFERSON DAVIS
72
3
12
83
237
70
76
24
47
62
220
1086
39
168
76
3,312
936
103
33
12
24
4
28
56
118
188
4
183
497
547
48
72
60
18
4
5
86
31
26
37
49

Figure 5B

Commuting Area 6: Adams County

Numbers of employed residents in each county except Adams declined from 1960 to 1970 (Table 6A), but commuters per 100 noncommuters increased (Table 6B). The commuting-hub status of Adams County (Type III) in 1960 became more apparent in 1970, primarily because of the large increase in numbers of commuters from Concordia Parish, Louisiana. Commuting into Adams County from adjacent Mississippi counties changed between the two census periods, primarily as the result of increases in commuting to Louisiana parishes south of the area (Figues 6A and 6B) and from Pike County in Area 7 (Figures 7A and 7B).

TABLE 6A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 6, (Adams County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status: Non-Commuters	Commuters: Destination Given	Commuters: Destination Not Given	Unaccounted for/or Not Reported
			1970		
Adams	12,101	10,167	455	155	1,324
Amite	3,948	2,552	870	138	388
Claiborne	2,765	2,046	429	59	231
Franklin	2,380	1,351	481	93	455
Jefferson	2,038	1,243	575	45	175
Wilkinson	2,992	1,915	699	115	263
			1960		
Adams	12,574	11,279	529	373	393
Amite	4,639	3,478	832	176	153
Claiborne	2,967	2,676	168	71	52
Franklin	2,674	1,935	586	76	77
Jefferson	2,709	2,076	369	119	145
Wilkinson	3,348	2,552	439	221	136

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 6B. COMMUTERS* PER 100 NON-COMMUTERS AREA 6, (Adams County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970 Total	1970 Urban	1970 Rural	1960 Total
Adams	6.0	6.5	5.3	8.0
Amite	39.5	---	39.5	29.0
Claiborne	23.9	11.5	31.4	9.0
Franklin	42.5	---	42.5	34.2
Jefferson	50.0	---	50.0	23.5
Wilkinson	42.5	---	42.5	25.9

Source: Computed from Table 6A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

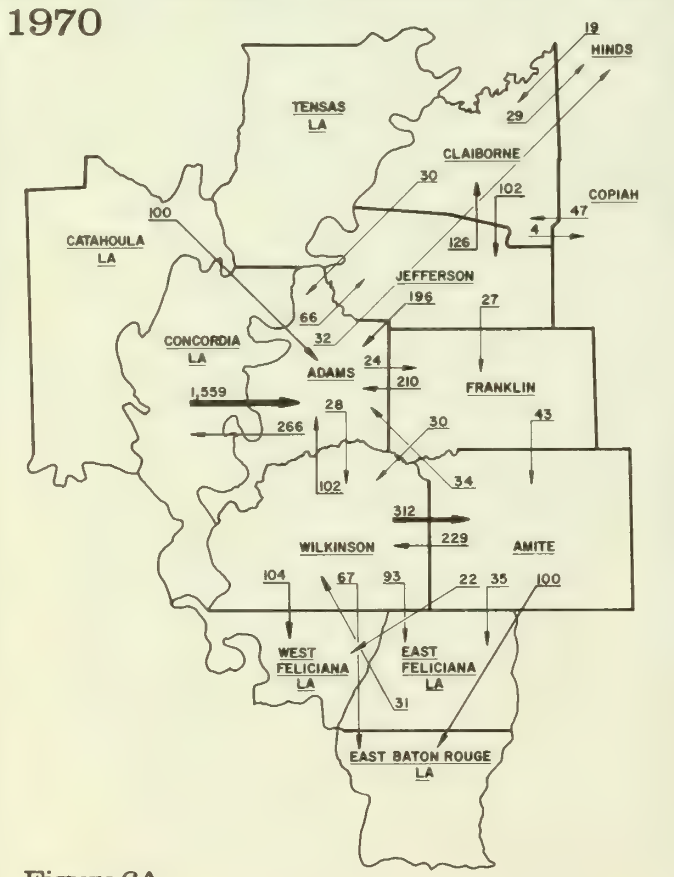
1970
19
HINDS
TENSAS LA
29
CLAIBORNE
30
102
COPIAH
100
47
CATAHOULA LA
4
126
JEFFERSON
66
196
27
CONCORDIA LA
32
ADAMS
24
210
FRANKLIN
1,559
28
266
30
43
102
34
312
WILKINSON
229
AMITE
104
67
93
22
35
100
WEST FELICIANA LA
EAST FELICIANA LA
31
EAST BATON ROUGE LA

Figure 6A

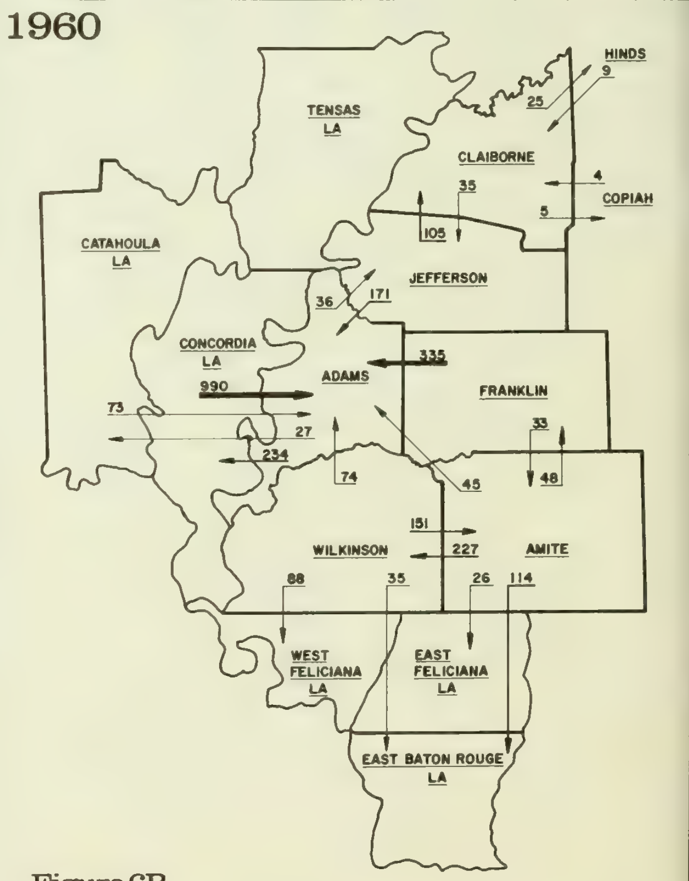
1960
HINDS
9
TENSAS LA
25
CLAIBORNE
4
35
COPIAH
5
CATAHOULA LA
105
JEFFERSON
36
171
CONCORDIA LA
335
ADAMS
990
FRANKLIN
73
27
33
234
74
45
48
151
WILKINSON
227
AMITE
88
35
26
114
WEST FELICIANA LA
EAST FELICIANA LA
EAST BATON ROUGE LA

Figure 6B

Commuting Area 7: Pike County

Only two counties (Type II counties Lawrence and Lincoln) reported increases in numbers of employed residents from 1960 to 1970 (Table 7A). Six counties experienced increases in numbers of commuters per 100 non-commuters (TAble 7B), despite decreases in numbers of employed residents.

Pike County (Type IV) became more dominant as a commuting hub, primarily as a result of increases in numbers of commuters from adjoining counties (Figures 7A and 7B). Commuting to jobs outside the area increased between the two census periods, with new streams reported to East Baton Rouge and New Orleans and to counties in other designated areas (Figures, 4A, 4B, 12A, 12B, 13A and 13B).

TABLE 7A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 7, (Pike County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status			Unaccounted for/or Not Reported
		Non-Commuters	Commuters		
			Destination Given	Destination Not Given	
			1970		
Amite	3,948	2,552	870	138	388
Copiah	7,471	5,714	1,261	178	323
Franklin	2,380	1,351	481	93	455
Jefferson Davis	3,607	2,503	788	190	126
Lawrence	3,101	1,907	426	206	562
Lincoln	8,942	6,489	1,001	516	936
Marion	6,917	5,137	459	413	908
Pike	10,333	8,616	515	212	990
Walthall	3,890	2,437	951	158	344
			1960		
Amite	4,639	3,478	832	176	153
Copiah	8,337	6,857	882	264	334
Franklin	2,674	1,935	586	76	77
Jefferson Davis	3,617	2,951	482	64	120
Lawrence	2,877	2,206	486	85	100
Lincoln	8,645	7,066	1,095	215	269
Marion	7,236	6,144	642	207	243
Pike	11,403	9,866	636	480	421
Walthall	4,358	3,536	573	129	120

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 7B. COMMUTERS* PER 100 NON-COMMUTERS AREA 7, (Pike County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970			1960
	Total	Urban	Rural	Total
Amite	39.5	---	39.5	29.0
Copiah	25.1	18.0	29.6	16.7
Franklin	42.5	---	42.5	34.2
Jefferson Davis	39.1	---	39.1	18.5
Lawrence	33.1	---	33.1	25.9
Lincoln	23.4	19.9	26.4	18.5
Marion	17.0	13.4	19.3	13.8
Pike	8.4	6.1	10.1	11.3
Walthall	45.5	---	45.5	19.9

Source: Computed from Table 7A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

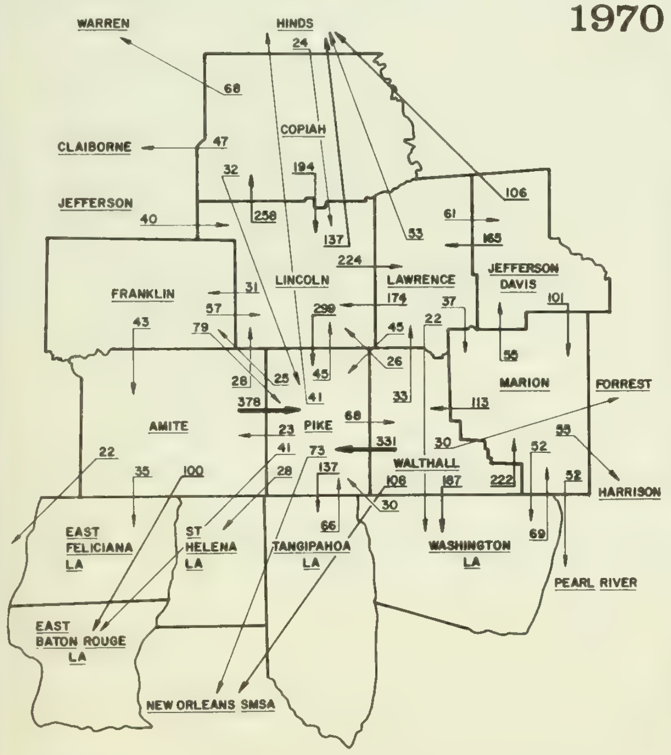
1970
WARREN
HINDS
24
68
CLAIBORNE
47
COPIAH
32
194
JEFFERSON
40
258
137
106
53
61
165
224
LINCOLN
LAWRENCE
JEFFERSON DAVIS
101
FRANKLIN
31
57
174
299
37
43
79
45
22
26
55
28
25
45
33
MARION
FORREST
378
41
113
AMITE
23
PIKE
68
331
30
55
22
41
73
WALTHALL
52
35
100
28
137
108
187
222
52
HARRISON
30
66
69
EAST FELICIANA LA
ST HELENA LA
TANGIPAHOA LA
WASHINGTON LA
PEARL RIVER
EAST BATON ROUGE LA
NEW ORLEANS SMSA

Figure 7A

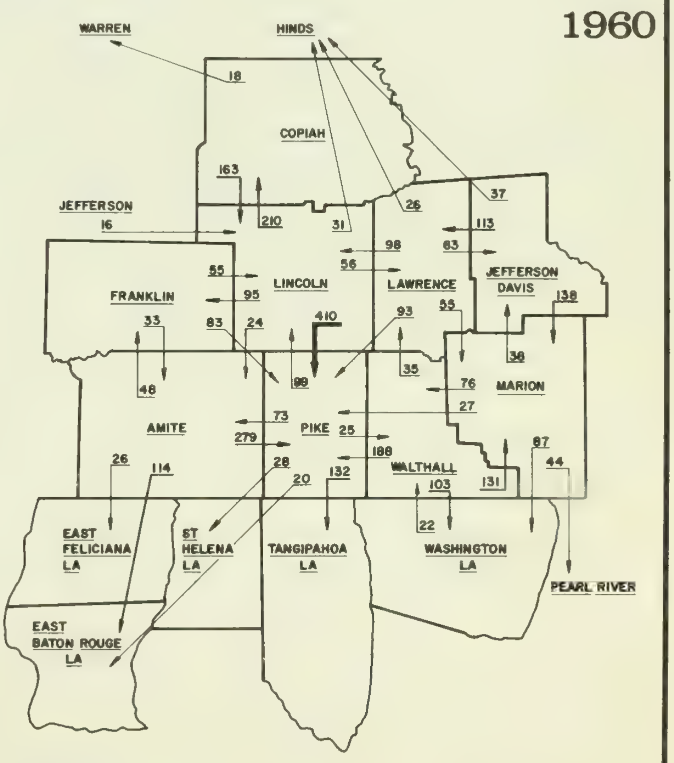
1960
WARREN
HINDS
18
COPIAH
163
37
JEFFERSON
26
16
210
31
113
98
63
56
55
LINCOLN
LAWRENCE
JEFFERSON DAVIS
FRANKLIN
95
138
33
83
24
410
93
55
99
38
35
48
76
MARION
27
AMITE
73
PIKE
25
279
188
26
114
28
20
132
WALTHALL
87
44
103
131
22
EAST FELICIANA LA
ST HELENA LA
TANGIPAHOA LA
WASHINGTON LA
PEARL RIVER
EAST BATON ROUGE LA

Figure 7B

Commuting Area 8: Alcorn County

The decline in numbers of employed residents in Alcorn and Marshall Counties was more than offset by increases in the other counties, and the total resident labor force of the area increased by almost 11% from 1960 to 1970. Commuting from each county increased over the decade (Table 8A), and the ratio of commuters to non-commuters in each county was larger in 1970 than in 1960 (Table 8B).

Alcorn County clearly had attained commuting-hub status by 1960, and the stature of the county as a commuting hub improved by 1970 (Figures 8A and 8B). Commuter exchanges within the area i 1970 were largely between ac joining counties, but the number c resident workers who commuted t jobs in Tennessee and Alabam and in other Mississippi countie was appreciably higher in 197 than in 1960 (Figures 1A, 1B, 9 and 9B).

TABLE 8A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 8, (Alcorn County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status			
		Non-commuters	Commuters		Unaccounted for/or Not Reported
			Destination Given	Destination Not Given	
1970					
Alcorn	9,793	8,807	527	174	1,005
Benton	2,251	1,316	618	32	285
Marshall	6,453	4,239	1,539	149	526
Prentiss	7,735	5,846	1,328	114	447
Tippah	5,747	4,378	696	65	608
Tishomingo	5,042	3,269	1,016	237	520
Union	6,982	5,248	1,138	130	466
1960					
Alcorn	10,335	7,738	446	78	2,073
Benton	2,222	1,645	415	32	130
Marshall	6,535	5,261	549	280	445
Prentiss	6,128	5,068	685	102	273
Tippah	5,244	4,714	270	121	138
Tishomingo	4,654	3,555	724	137	238
Union	6,008	4,881	603	363	161

Source: See Table 1A.

*Based on the population 16 and over in 1970 and 14 and over in 1960.

TABLE 8B. COMMUTERS* PER 100 NON-COMMUTERS AREA 8, (Alcorn County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970			1960
	Total	Urban	Rural	Total
Alcorn	8.7	8.8	8.6	6.8
Benton	49.4	---	49.4	27.2
Marshall	39.8	5.2	60.9	15.8
Prentiss	24.7	12.0	31.7	15.5
Tippah	17.4	8.8	20.7	8.3
Tishomingo	38.3	---	38.3	24.2
Union	24.2	8.5	34.5	19.8

Source: Computed from Table 8A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

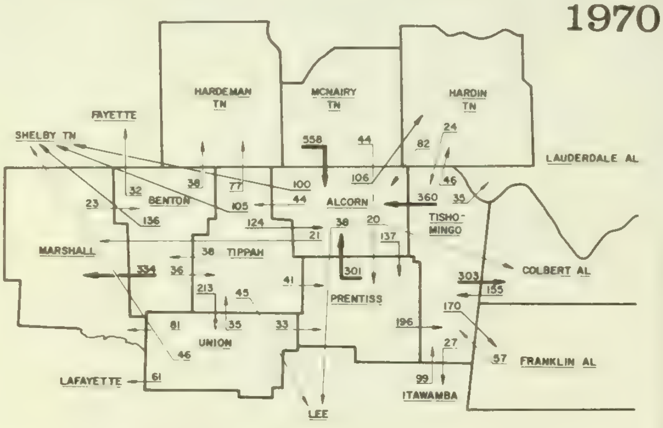
1970
HARDEMAN TN
MCNAIRY TN
HARDIN TN
FAYETTE
SHELBY TN
LAUDERDALE AL
BENTON
ALCORN
TISHO-MINGO
MARSHALL
TIPPAH
PRENTISS
COLBERT AL
UNION
FRANKLIN AL
LAFAYETTE
LEE
ITAWAMBA
558
44
82
24
106
46
100
38
77
32
23
136
105
44
360
35
124
38
20
21
137
38
334
36
301
303
155
213
45
41
170
81
35
33
196
46
27
57
61
99

Figure 8A

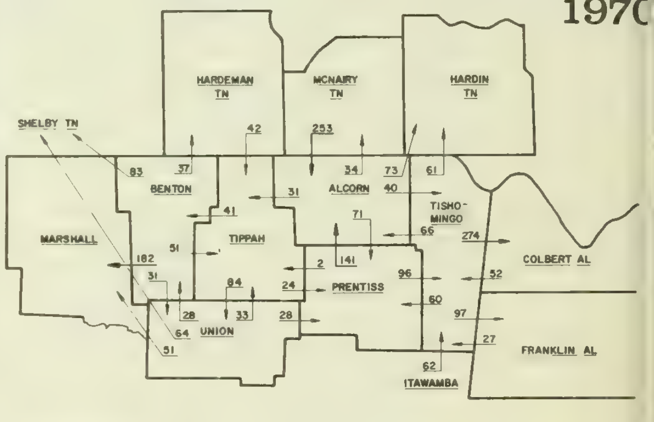
197
HARDEMAN TN
MCNAIRY TN
HARDIN TN
SHELBY TN
BENTON
ALCORN
TISHO-MINGO
MARSHALL
TIPPAH
PRENTISS
COLBERT AL
UNION
FRANKLIN AL
ITAWAMBA
42
253
83
37
34
73
61
31
40
41
71
66
274
51
182
2
141
96
52
31
84
24
60
28
33
28
97
64
27
51
62

Figure 8B

Commuting Area 9: Lee County

Numbers of employed residents and numbers of commuters increased in each county between 1960 and 1970 (Table 9A), and the number of commuters per 100 non-commuters increased in all counties except Lee (Table 9B). The economic dominance of Lee County had been well established by 1960, and notable gains were made by 1970. Commuting by residents of the area increased by more than 40% from 1960 to 1970, with commuting into Lee County from adjoining Mississippi counties accounting for most of the increase (Figures 9A and 9B). Workers were exchanged in both years with Tennessee and Alabama and with Mississippi counties south and west of the area (Figures 3A, 3B, 8A, 8B, 10A and 10B).

TABLE 9A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 9, (Lee County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status			Unaccounted for/or Not Reported
		Non-Commuters	Commuters		
			Destination Given	Destination Not Given	
		1970			
Chickasaw	5,274	4,603	721	80	320
Itawamba	6,424	3,745	2,106	165	408
Lee	18,713	16,144	877	277	1,415
Monroe	12,759	10,198	1,787	247	527
Pontotoc	6,033	3,851	1,828	57	297
Prentiss	7,735	5,846	1,328	114	447
Union	6,982	5,248	1,138	130	466
		1960			
Chickasaw	5,678	4,922	370	70	316
Itawamba	5,533	3,857	1,391	57	228
Lee	14,980	13,362	750	371	497
Monroe	12,122	9,844	1,313	404	561
Pontotoc	5,225	3,880	992	149	204
Prentiss	6,128	5,068	685	102	273
Union	6,197	4,881	603	363	350

Source: See Table 1A.

*Based on the population 16 and over in 1970 and 14 and over in 1960.

TABLE 9B. COMMUTERS* PER 100 NON-COMMUTERS AREA 9, (Lee County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970			1960
	Total	Urban	Rural	Total
Chickasaw	17.4	11.5	21.7	8.9
Itawamba	60.6	19.2	75.4	37.5
Lee	7.1	4.5	9.5	8.4
Monroe	19.9	8.2	30.3	17.4
Pontotoc	48.9	21.5	61.0	29.4
Prentiss	24.7	12.0	31.7	15.5
Union	24.2	8.5	34.5	19.8

Source: Computed from Table 9A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

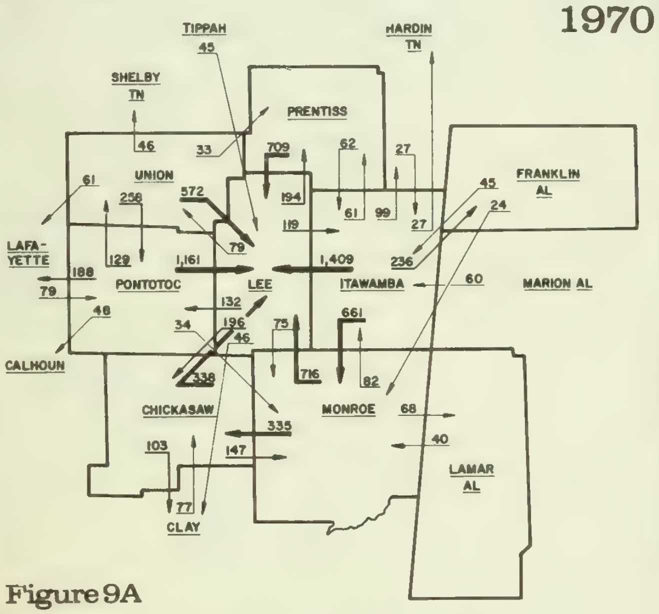
1970
TIPPAH
45
HARDIN
TN
SHELBY
TN
PRENTISS
46
33
709
62
27
61
UNION
258
572
194
FRANKLIN
AL
45
24
61
99
27
119
LAFA-
YETTE
129
1,161
79
1,409
236
188
79
PONTOTOC
LEE
ITAWAMBA
60
MARION AL
132
48
34
196
46
75
661
CALHOUN
338
716
82
CHICKASAW
MONROE
68
335
40
103
147
LAMAR
AL
77
CLAY

Figure 9A

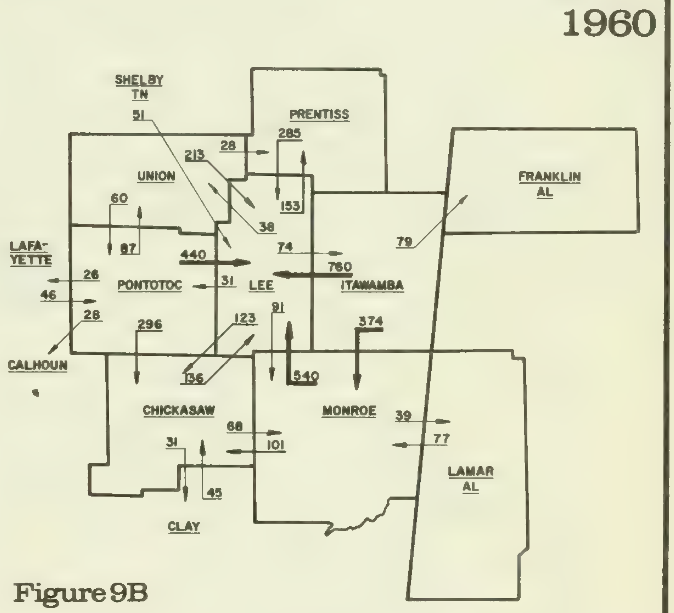
1960
SHELBY
TN
51
PRENTISS
28
285
213
UNION
153
FRANKLIN
AL
60
38
87
74
79
LAFA-
YETTE
440
760
26
PONTOTOC
31
LEE
ITAWAMBA
46
28
296
123
91
374
CALHOUN
136
540
CHICKASAW
MONROE
39
68
101
77
31
45
LAMAR
AL
CLAY

Figure 9B

Commuting Area 10: Golden Triangle

Two counties (Clay and Oktibbeha) were Type I counties and the decreases in numbers of commuters per 100 non-commuters from 1960 to 1970 (Table 10B) were associated with decreases in total numbers of commuters (Table 10A). Increases in numbers of employed residents in the three Type II counties (Choctaw, Lowndes and Monroe) were accompanied by increases in numbers of commuters and in numbers of commuters per 100 non-commuters. Numbers commuting from the three Type III counties (Noxubee, Webster and Winston) increased over the ten-year period, despite decreases in numbers of employed residents.

The relatively low ratio of commuters to non-commuters for Clay, Oktibbeha and Lowndes Counties indicate that all three were commuter hubs in 1970. Lowndes County's strongest commuter linkages were with Alabama in both years, but Lowndes also attracted the largest numbers of commuters from surrounding Mississippi counties (Figures 10A and 10B). Commuter exchanges between Lowndes and Oktibbeha and between Lowndes and Clay became more nearly equal in 1970, and commuter streams from Oktibbeha, Monroe and Webster increased sufficiently to elevate Clay County to the status of a secondary commuter hub. Commuting patterns of the areas were linked weakly to Areas 3, 9 and 11 in both census periods (Figures 3A, 3B, 9A, 9B, 11A and 11B).

TABLE 10A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 10, (Golden Triangle), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status			
		Non-Commuters	Commuters		Unaccounted for/or Not Reported
			Destination Given	Destination Not Given	
			1970		
Choctaw	2,515	1,524	785	45	161
Clay	6,331	5,348	412	117	454
Lowndes	19,008	16,576	487	353	3,539
Monroe	12,759	10,198	1,787	247	527
Noxubee	3,932	3,236	417	31	248
Oktibbeha	9,530	8,090	648	117	675
Webster	3,220	2,298	876	38	8
Winston	5,575	4,288	487	345	455
			1960		
Choctaw	2,501	1,731	476	79	215
Clay	6,199	5,418	441	148	192
Lowndes	16,818	15,738	326	288	466
Monroe	12,122	9,844	1,313	404	561
Noxubee	4,796	4,121	257	162	256
Oktibbeha	8,304	7,167	462	388	337
Webster	3,264	2,658	440	83	83
Winston	5,635	4,915	424	129	167

Source: See Table 1A.

*Based on the population 16 and over in 1970 and 14 and over in 1960

TABLE 10B. COMMUTERS* PER 100 NON-COMMUTERS AREA 10, (Golden Triangle), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970			1960
	Total	Urban	Rural	Total
Choctaw	54.5	---	54.5	32.1
Clay	9.9	7.4	12.8	10.9
Lowndes	5.1	4.2	6.6	3.9
Monroe	19.9	8.2	30.3	17.4
Noxubee	13.8	7.1	16.6	10.2
Oktibbeha	9.5	7.9	11.9	11.2
Webster	39.8	---	39.8	19.7
Winston	19.4	21.2	18.0	11.3

Source: Computed from Table 10A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

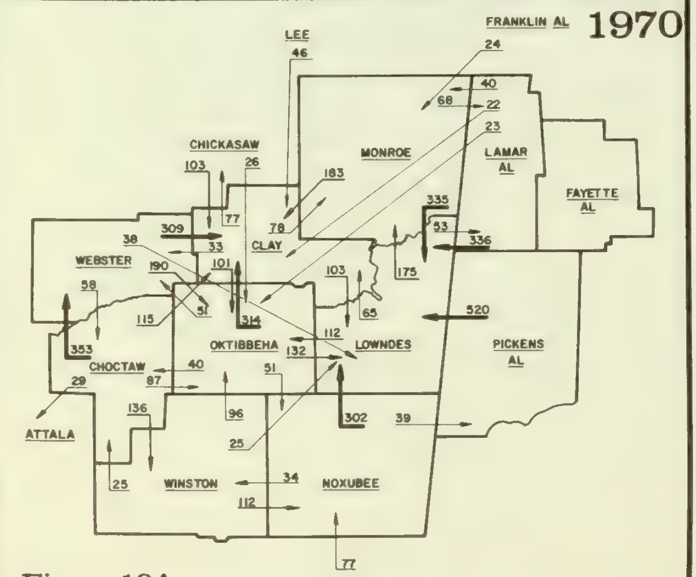
1970
FRANKLIN AL
24
LEE
46
40
68
22
23
CHICKASAW
103
26
MONROE
183
LAMAR AL
FAYETTE AL
335
309
77
78
53
336
38
33
CLAY
WEBSTER
190
101
103
175
58
51
65
520
115
314
112
353
OKTIBBEHA
132
LOWNDES
PICKENS AL
CHOCTAW
40
29
87
51
ATTALA
136
96
302
39
25
25
WINSTON
34
NOXUBEE
112
77
KEMPER

Figure 10A

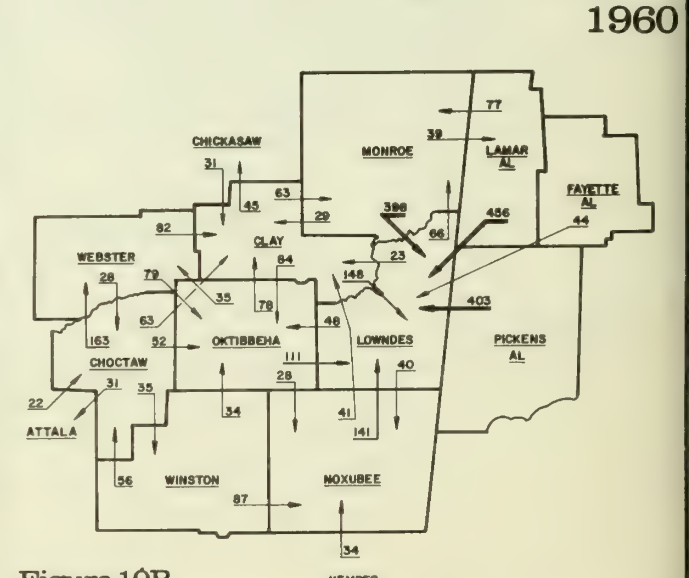
1960
77
CHICKASAW
MONROE
39
LAMAR AL
31
63
45
29
398
456
FAYETTE AL
82
66
44
CLAY
23
WEBSTER
84
148
28
79
35
78
403
63
48
163
52
OKTIBBEHA
LOWNDES
PICKENS AL
CHOCTAW
111
40
28
22
31
35
ATTALA
34
41
141
56
WINSTON
NOXUBEE
87
34
KEMPER

Figure 10B

Commuting Area 11: Lauderdale County

Two counties (Lauderdale and Neshoba) were Type I counties and the decreases in numbers of commuters per 100 non-commuters from 1960 to 1970 (Table 11B) were associated with decreases in total numbers of commuters (Table 11A). Increases in numbers of employed residents in the five Type II counties (Clarke, Jasper, Leake, Newton and Scott) were accompanied by increases in numbers of commuters and in numbers of commuters per 100 non-commuters. Numbers commuting from the two Type III counties (Kemper and Winston) increased over the decade, despite decreases in numbers of employed residents, and these changes were associated with increases in numbers of commuters per 100 non-commuters.

Commuting into Lauderdale County from almost all other counties in the area increased from 1960 to 1970, with the flows from Newton and Clarke Counties growing by 50 and 75%, respectively, and the flow from Kemper County doubling (Figures 11A and 11B). Numbers commuting from Lauderdale County to other counties in the area also increased. Several counties in the area had closer commuting ties with Mississippi counties outside the area (Figures 5A, 5B, 10A, 10B, 12A and 12B).

TABLE 11A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 11, (Lauderdale County), BY COUNTY, MISSISSIPPI, 1970 AND 1980.

		Commuting Status			
		Non-Commuters	Commuters		
Counties	Number of Employed Residents*		Destination Given	Destination Not Given	Unaccounted for/or Not Reported
			1970		
Clarke	4,960	3,316	823	229	592
Jasper	4,622	2,368	1,419	116	719
Kemper	2,673	1,678	771	38	186
Lauderdale	25,121	21,794	475	484	2,368
Leake	5,402	3,726	999	104	573
Neshoba	7,120	5,644	957	125	394
Newton	6,599	4,937	1,164	126	372
Scott	7,032	5,313	783	171	765
Winston	5,575	4,288	487	345	455
			1960		
Clarke	4,940	3,953	683	115	189
Jasper	4,569	3,349	872	144	204
Kemper	3,572	2,838	379	141	214
Lauderdale	23,921	21,719	788	717	697
Leake	5,206	4,062	688	208	248
Neshoba	6,748	5,150	1,035	247	316
Newton	6,343	5,184	734	187	238
Scott	6,659	5,656	548	140	315
Winston	5,635	4,915	424	129	167

Source: See Table 1A.

*Based on the population 16 and over in 1970 and 14 and over in 1960.

TABLE 11B. COMMUTERS* PER 100 NON-COMMUTERS AREA 11, (Lauderdale County), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

	1970			1960
Counties	Total	Urban	Rural	Total
Clarke	31.7	18.5	36.0	20.2
Jasper	64.8	---	64.8	30.3
Kemper	48.2	---	48.2	18.3
Lauderdale	4.4	3.9	5.5	6.9
Leake	29.6	10.3	37.1	22.1
Neshoba	19.2	6.7	27.2	24.9
Newton	26.1	8.5	32.2	17.8
Scott	18.0	10.4	23.3	12.2
Winston	19.4	21.6	18.0	11.3

Source: Computed from Table 11A and comparable Census data for rural/urban areas, 1970.

*See Footnotes, Table 1B.

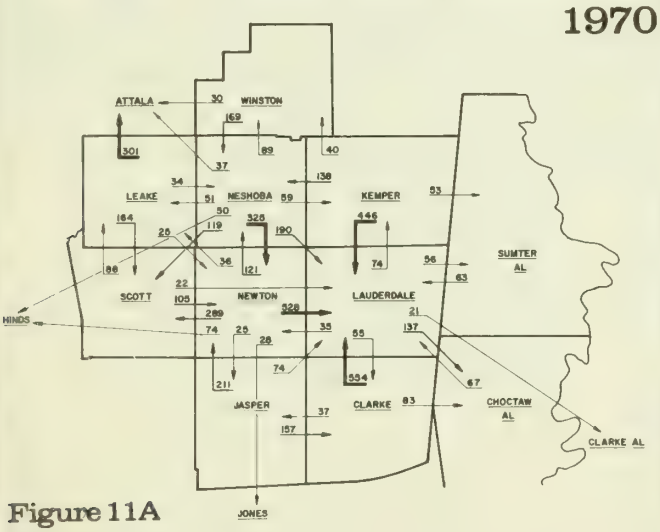
1970
ATTALA
30
WINSTON
169
301
89
40
37
138
34
LEAKE
51
NESHOBA
59
KEMPER
53
50
326
446
164
119
26
190
36
121
74
56
SUMTER
AL
88
22
63
SCOTT
105
NEWTON
LAUDERDALE
289
328
21
HINDS
74
25
35
137
28
55
74
554
211
67
JASPER
CLARKE
83
CHOCTAW
AL
37
157
CLARKE AL
JONES

Figure 11A

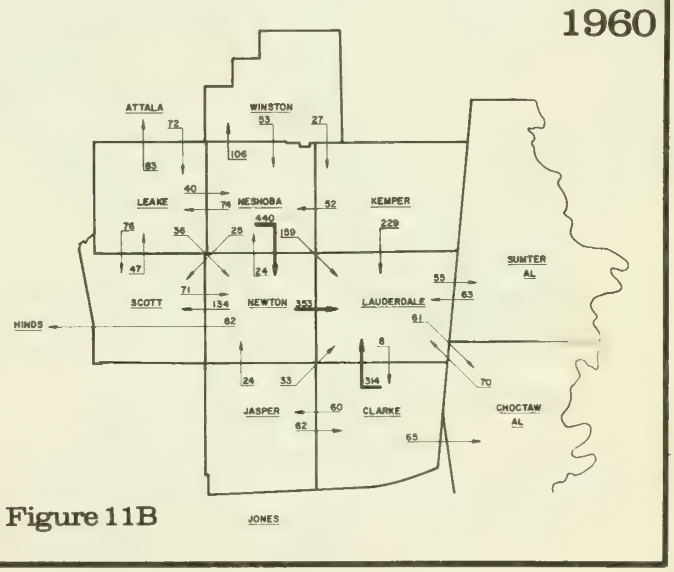
1960
ATTALA
WINSTON
72
53
27
83
106
40
LEAKE
74
NESHOBA
52
KEMPER
440
76
36
25
159
229
47
24
55
SUMTER
AL
71
63
SCOTT
134
NEWTON
353
LAUDERDALE
HINDS
62
61
8
24
33
314
70
JASPER
60
CLARKE
CHOCTAW
AL
62
65
JONES

Figure 11B

Commuting Area 12: Forrest and Jones Counties

The decrease in numbers of commuters per 100 non-commuters in Forrest County (Type I) from 1960 to 1970 (Table 12B) was associated with a decrease in total numbers of commuters (Table 12A). Increases in the commuter to non-commuter ratio in two of the Type II counties (Simpson and Wayne) and in Smith County (Type III) were accompanied by decreases in total numbers of commuters. Other counties in the area experienced increases in numbers of commuters per 100 non-commuters and in total numbers of commuters.

The exchange of commuters between the two commuting hub counties (Forrest and Jones) i
creased between the two censu
dates (Figures 12A and 12B), wit
Forrest roughly holding a 2 to
exchange ratio in both year
Lamar County had the secon
highest commuter to no
commuter ratio in the state in 197
indicating the extent to which t
county is serving as a suburba

TABLE 12A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 12, (Forrest-Jones Counties), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	Number of Employed Residents*	Commuting Status: Non-Commuters	Commuting Status: Commuters: Destination Given	Commuting Status: Commuters: Destination Not Given	Unaccounted for/or Not Reported
			1970		
Clarke	4,960	3,316	823	229	592
Covington	4,405	2,794	996	180	435
Forrest	20,877	17,301	998	651	1,927
Greene	2,441	1,383	681	71	306
Jasper	4,622	2,368	1,419	116	719
Jefferson Davis	3,607	2,503	788	190	126
Jones	18,977	15,185	1,110	619	2,063
Lamar	4,697	2,339	1,771	187	400
Marion	6,917	5,137	459	413	908
Perry	2,846	1,470	813	116	444
Simpson	6,607	4,321	1,143	122	1,021
Smith	4,576	2,567	801	134	1,074
Wayne	4,972	2,988	553	131	1,300
			1960		
Clarke	4,940	3,953	683	115	189
Covington	4,057	3,095	685	147	130
Forrest	18,201	15,826	1,134	705	534
Greene	2,083	1,306	541	143	91
Jasper	4,569	3,349	872	144	204
Jefferson Davis	3,617	2,951	482	64	120
Jones	18,237	16,265	736	640	596
Lamar	4,146	2,781	1,084	139	142
Marion	7,236	6,144	642	207	243
Perry	2,738	1,904	629	84	121
Simpson	6,161	4,701	1,104	201	155
Smith	5,217	4,141	850	114	112
Wayne	4,347	3,490	635	102	120

Source: See Table 1A.

*Based on population 16 and over in 1970 and 14 and over in 1960.

TABLE 12B. COMMUTERS* PER 100 NON-COMMUTERS AREA 12, (Forrest-Jones Counties), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

Counties	1970 Total	1970 Urban	1970 Rural	1960 Total
Clarke	31.7	18.5	36.0	20.2
Covington	42.1	---	42.1	26.9
Forrest	9.5	9.0	12.0	11.6
Greene	54.4	---	54.4	52.3
Jasper	64.8	---	64.8	30.3
Jefferson Davis	39.1	---	39.1	18.5
Jones	11.4	6.4	17.0	8.5
Lamar	83.5	466.6	79.6	44.0
Marion	17.0	13.4	19.3	13.8
Perry	63.4	---	63.4	37.4
Simpson	29.3	25.1	29.8	27.8
Smith	36.4	---	36.4	23.3
Wayne	22.9	3.8	32.1	21.1

Source: Computed from Table 12A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

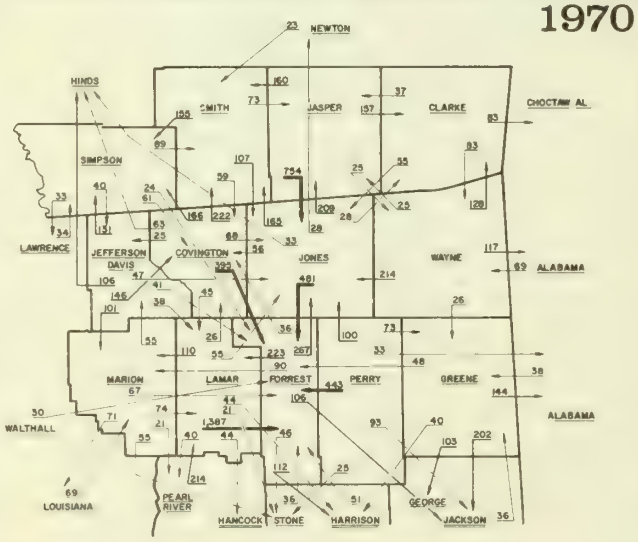
1970
NEWTON
HINDS
SMITH
JASPER
CLARKE
CHOCTAW AL
SIMPSON
LAWRENCE
JEFFERSON DAVIS
COVINGTON
JONES
WAYNE
ALABAMA
MARION
LAMAR
FORREST
PERRY
GREENE
ALABAMA
WALTHALL
LOUISIANA
PEARL RIVER
HANCOCK
STONE
HARRISON
GEORGE
JACKSON
23
160
73
37
157
83
155
89
107
59
754
25
55
83
33
40
24
61
166
222
165
209
28
25
128
34
131
63
25
68
56
33
28
117
69
47
106
146
41
395
481
214
101
38
45
26
36
267
100
73
26
55
110
55
223
90
33
48
38
67
443
106
144
30
71
74
44
21
1,387
44
46
93
40
21
55
40
103
202
214
112
25
69
36
51
36

Figure 12A

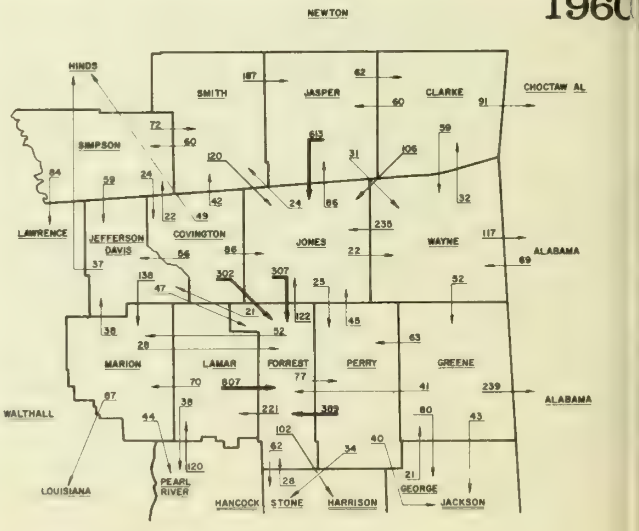
1960
NEWTON
HINDS
SMITH
JASPER
CLARKE
CHOCTAW AL
SIMPSON
LAWRENCE
JEFFERSON DAVIS
COVINGTON
JONES
WAYNE
ALABAMA
MARION
LAMAR
FORREST
PERRY
GREENE
ALABAMA
WALTHALL
LOUISIANA
PEARL RIVER
HANCOCK
STONE
HARRISON
GEORGE
JACKSON
187
62
60
91
72
60
613
31
106
59
120
84
59
24
42
24
86
32
22
49
235
117
86
56
22
69
37
302
307
25
52
138
47
21
122
45
38
52
63
28
77
70
807
41
239
87
38
221
389
44
80
43
102
62
34
40
120
28
21

Figure 12B

expansion from Forrest County.

Aside from the increase in total numbers of commuters from 1960 to 1970, the commuting pattern within the area was similar in both years. Many counties in the periphery of the area maintained commuter linkages with Mississippi counties in other areas, primarily the linkage of Clarke County with Lauderdale County (Figures 11A and 11B), Greene and Marion Counties with the coastal counties (Figures 13A and 13B) and Marion County with Area 7 (Figures 7A and 7B). New commuter streams from Harrison County to Forrest County and from Louisiana to Marion County developed over the decade.

Commuting Area 13: Biloxi-Gulfport and Pascagoula-Moss Point SMSAs

All counties in the area experienced increases in numbers of resident workers, in numbers of non-commuters and in numbers of commuters (Table 13A), but the ratio of commuters to non-commuters in 1970 still was higher than in 1960 for all counties except Hancock (Table 13B). Jackson and Harrison Counties (Type II) are major commuting hubs and Hancock County (Type I and a "growing hub") is developing the characteristics of a commuting hub.

The area demonstrates more than any of the other designated areas the extent to which inter-county commuting can mushroom in all directions in an industrially developing area (Figures 13A and 13B). Numbers of workers crossing at least one county line to reach their place of work almost doubled from 1960 to 1970, and workers traveling to jobs from outside the six-county area increased from 15% of the total commuting stream in 1960 to 30% in 1970. Commuting from the area to Alabama and Louisiana decreased over the decade, while commuting from these states into the area increased. Commuting into the area from other Mississippi counties (Figures 12A and 12B) also increased appreciably over the decade.

TABLE 13A. EMPLOYED RESIDENTS, TOTAL AND BY COMMUTING STATUS, AREA 13, (Biloxi, Gulfport and Pascagoula-Moss Point SMSAs), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

		Commuting Status			
		Non-Commuters	Commuters		
Counties	Number of Employed Residents*		Destination Given	Destination Not Given	Unaccounted for/or Not Reported
			1970		
George	3,827	2,184	1,191	109	343
Hancock	5,525	3,506	1,255	192	572
Harrison	53,357	45,620	2,209	658	4,870
Jackson	30,832	23,554	3,594	456	3,228
Pearl River	9,015	5,754	2,519	198	544
Stone	2,832	1,815	653	15	349
			1960		
George	3,192	2,141	793	21	237
Hancock	4,022	2,500	999	99	424
Harrison	45,443	41,376	1,024	372	2,671
Jackson	18,264	14,970	1,914	150	1,230
Pearl River	6,883	5,401	925	161	396
Stone	2,100	1,523	402	43	132

Source: See Table 1A.

*Based on the population aged 16 and over in 1970 and 14 and over in 1960.

TABLE 13B. COMMUTERS* PER 100 NON-COMMUTERS AREA 13, (Biloxi-Gulfport and Pascagoula-Moss Point, SMSAs), BY COUNTY, MISSISSIPPI, 1970 AND 1960.

	1970			1960
Counties	Total	Urban	Rural	Total
George	59.5	---	59.5	38.0
Hancock	41.3	28.4	68.5	43.9
Harrison	6.3	5.9	8.5	3.4
Jackson	17.2	15.5	22.1	13.8
Pearl River	47.2	44.1	49.3	20.1
Stone	36.8	20.5	49.2	29.2

Source: Computed from Table 13A and comparable Census data for rural/urban areas, 1970.

*See Footnote, Table 1B.

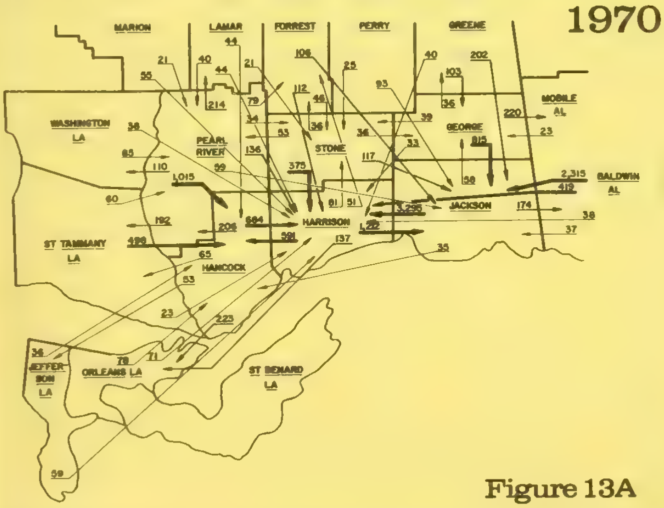
1970
MARION
LAMAR
FORREST
PERRY
GREENE
44
21
40
44
21
106
25
40
202
55
214
79
112
46
93
103
36
MOBILE AL
WASHINGTON LA
38
34
53
36
39
220
23
GEORGE
815
PEARL RIVER
136
STONE
36
33
65
110
1,015
99
375
117
58
2,315
419
BALDWIN AL
60
81
51
3,295
JACKSON
174
38
192
206
684
HARRISON
1,222
37
ST TAMMANY LA
499
591
137
35
65
HANCOCK
53
23
223
34
JEFFERSON LA
78
71
ORLEANS LA
ST BENARD LA
59

Figure 13A

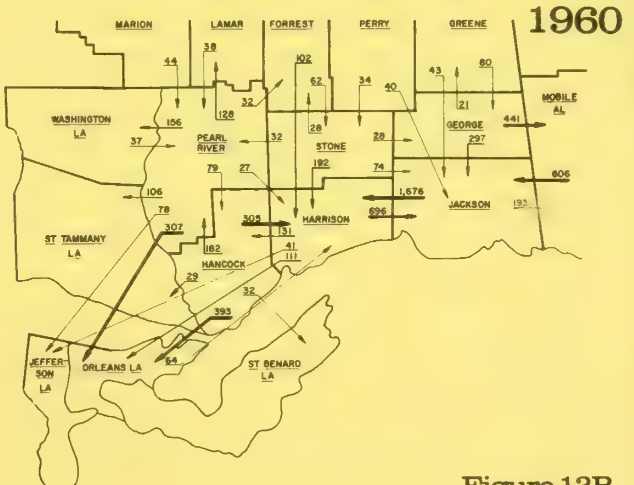
1960
MARION
LAMAR
FORREST
PERRY
GREENE
38
44
102
62
34
40
43
80
32
128
21
MOBILE AL
WASHINGTON LA
156
28
GEORGE
441
37
PEARL RIVER
32
STONE
28
297
79
27
192
74
606
106
1,676
JACKSON
193
78
696
305
HARRISON
307
131
ST TAMMANY LA
162
41
111
HANCOCK
29
32
393
JEFFERSON LA
ORLEANS LA
64
ST BENARD LA

Figure 13B

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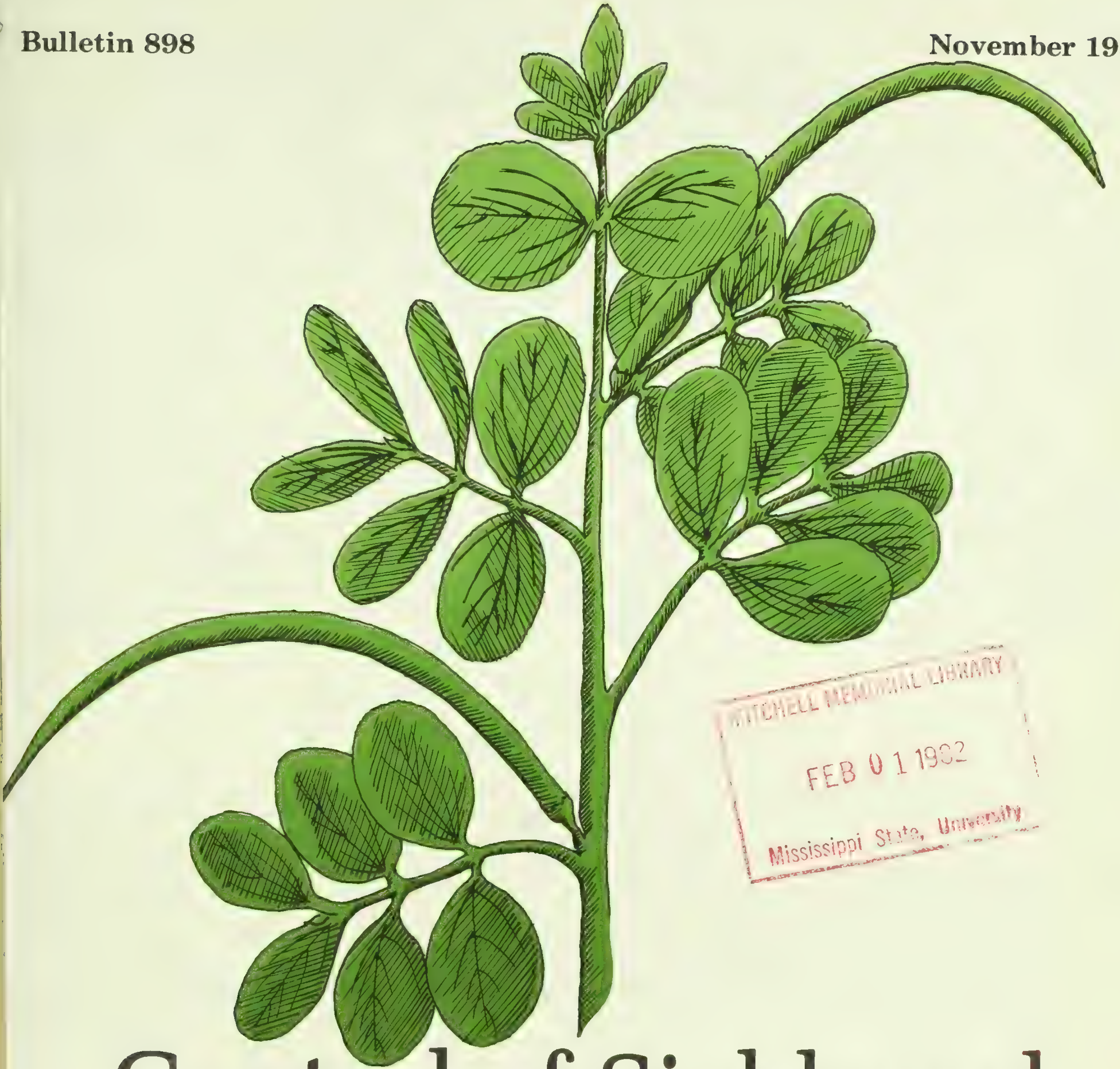

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Control of Sicklepod (*Cassia obtusifolia* L.) in Soybeans

C. H. Hovermale • H. R. Hurst

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Control of Sicklepod (*Cassia obtusifolia* L.) in Soybeans

Sicklepod (*Cassia obtusifolia* L.) has progressed in 20 years from a troublesome weed along the Gulf coast of Mississippi, Louisiana, Alabama and Georgia to a primary production problem that is spreading northward at an alarming rate. This weed has been present for many years, but the combination of crops and cropping practices followed did not permit it to become a problem.

Conditions for the growth and spread of sicklepod became favorable when soybeans became a popular crop. Sicklepod is a very aggressive legume that does not nodulate and will attain a height of 6 to 8 ft and a basal stem diameter of up to 1/2 inch under favorable conditions. It will take over a soybean field.

Sicklepod is a prolific seed producer, and yields of up to 1000 lbs/acre have been reported (1). One pound contains about 3000 seed with about 15% germination the first year, and one year of seed production at only 500 lbs/acre provides almost 1/4 million viable seed. Control of the weed is very difficult after two years.

Sicklepod in corn or pasture can be controlled easily with phenoxy herbicides. However, the phenoxy herbicides are phytotoxic to soybeans, and control of sicklepod in soybeans can be accomplished only by a program of preplant incorporated and/or preemergence applications of herbicides followed by timely applications of postemergence herbicides.

Postemergence herbicides can be applied over-the-top of soybeans or directed to spray weeds with minimal contact of herbicides with soybean plants---preferably less than the lower 1/4 of the plant. Both methods were used in the study reported herein.

Materials and Methods

Studies were conducted at the MAFES South Mississippi Branch in 1978, 1979 and 1980. Soil in the test area is a sandy loam with CEC of 5.0, organic content of 1% and pH of 6.0.

Main plots were treatments with combinations of herbicides applied preplant incorporated or preemergence, plus a cultivated check, a hand-hoed check and a weedy check, and combinations of herbicides were applied over-the-top or post directed to one half of each main plot (Tables 1, 2 and 3).

Bragg soybeans were planted May 17, 1978, June 8, 1979 and June 20, 1980. All preplant and/or preemergence herbicides were applied on the day of planting. Row widths were 40 inches in 1978 and 1979, 30 inches in 1980.

Preplant, preemergence and over-the-top herbicides were applied in 20 gal water with a tractor-mounted sprayer. Directed postemergence herbicides were applied with commercial fender equipment in 1978 and 1979, and a slide applicator built by station personnel was used in 1980. The preplant herbicides were incorporated with a 12-ft disc followed by a mulcher/packer.

The trials were harvested with a four-row John Deere combine, and yields were adjusted for foreign matter and to 13% moisture.

Results

Yields from plots treated with herbicides applied preplant incorporated or preemergence without follow-up post treatments were higher (with a few exceptions) than yields from the weedy check (Table 4). Weeds were controlled more effectively and soybean yields were higher (with few exceptions) on plots where post directed or over-the-top herbicide applications were superimposed on the preplant incorporated or preemergence treatments than on plots where only preplant incorporated or preemergence herbicides were applied.

Post directed applications of metribuzin plus surfactant gave good contact control and demonstrated potential for suppression of sicklepod emergence when climatic conditions were favorable but did not give good control of grasses more than 2 to 3 inches tall. Effectiveness of post directed applications of linuron plus surfactant was about equal to that of metribuzin plus surfactant, but linuron was slightly more effective than metribuzin on larger grasses. Paraquat also gave excellent sicklepod kill and was the only material that killed large sicklepod and grasses, but only when adequate coverage was obtained. However, paraquat must be applied carefully to avoid the girdling or weakening of soybean stems that occurs when the material is deposited too far above ground level. Drift problems with paraquat also have been reported.

Table 1. Design of a herbicide trial for control of sicklepod in soybeans, MAFES South Mississippi Branch, 1978.

		Treatments				
1	A*	Trifluralin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre I***
	B**	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D****
2	A	Pendimethalin 4E	(.5 lb a.i./A)	+ Metribuzin 4	(.375 lb a.i./A)	Pre I
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
3	A	Pendimethalin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.25 lb a.i./A)	Pre I
	B	Linuron 50W	(.5 lb a.i./A)	+ Surfactant	(.5%)	Post D
4	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4 L	(.25 lb a.i./A)	Pre E*****
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
5	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
6	A	Alachlor 4E	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
7	A	Alachlor 4E	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Paraquat 2 CL	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
8	A	Alachlor 4E	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.5%)	Post D
9	A	Alachlor 4E + cultivation	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
10	A	Pendimethalin 4E + Metribuzin 4L	(.5 lb a.i./A) (.25 lb a.i./A)	+ Metribuzin 4L	(.25 lb a.i./A)	Pre I Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
11	A	Cultivate				
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
12	A	Hand Hoed				
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D
13	A	Weedy Check				
	B	Chloroxuron 50W	(.5 lb a.i./A)	+ NPO	(1 gal/A)	Post D

*Preplant incorporated or preemergence treatment of each main plot.

**Post directed treatment of one half of each main plot.

***Preplant incorporated

****Post directed

*****Preemergence

Discussion

Metribuzin (Sencor® or Lexone®) was included in each preplant incorporated and preemergence treatment because of its effectiveness against sicklepod, but the highest rate of metribuzin that can be applied to coarse-textured, low-organic matter soils is 0.5 lb ai/acre, a rate that gives control of sicklepod for only four to six weeks. Soybeans grown on 30- and 40-inch rows do not develop enough canopy to shade the row middles after only four to six weeks after planting, and sicklepod will develop and compete aggressively with them for nutrients, light and moisture. Therefore, post emergence applications of herbicides are required for sicklepod, and it is imperative that these applications be made while the sicklepod plants are young and tender.

Control of sicklepod for four to six weeks enables soybeans to reach a height of 8 to 12 inches before emerging sicklepod plants reach a height of 2 to 5 inches. This height differential is critical because the herbicides registered for post treatment generally call for soybeans to be 8 to 12 inches tall and weeds to be 1 to 3 inches tall.

Table 2. Design of a herbicide trial for control of sicklepod in soybeans, MAFES South Mississippi Branch, 1979.

			Treatments			
1	A*	Trifluralin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.375 lbs a.i./A)	Pre I***
	B**	Toxaphene 6E	(2.0 lb a.i./A)			OT****
2	A	Pendimethalin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre I
	B	Toxaphene 6E	(1.0 lb a.i./A)	+ Bentazon 4E	(.75 lb ai.i/A)	OT
3	A	Pendimethalin 4E	(.75 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre I
	B	Linuron 50W	(.5 lb a.i./A)	+ Surfactant	(.25%)	Post D*****
4	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E******
	B	Toxaphene 6E	(1.0 lb a.i./A)	+ Acifluorfen 2S	(.375 lb a.i./A)	OT
5	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Toxaphene 6E	(1.0 lb a.i./A)	+ Mefluidide 2S	(.25 lb a.i./A)	
		+ Surfactant	(.25%)			OT
6	A	Alachlor 4E	3.0 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Bentazon 4E	(.5 lb a.i./A)	+ Mefluidide 2S	(.25 lb a.i./A)	
		+ Surfactant	(.25%)			OT
7	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Paraquat 2 CL	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
8	A	Alachlor 4E	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	OT
9	A	Alachlor 4E	(.25 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
		+ cultivation				
	B	Linuron 50W	(.5 lb a.i./A)	+ Surfactant	(.25%)	Post D
10	A	Pendimethalin	(.5 lb a.i./A)	+ Metribuzin 4L	(.25 lb a.i./A)	Pre I
		+Metribuzin 4L	(.25 lb a.i./A)			Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
11	A	Cultivate				
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
12	A	Hand Hoed				
	B	Linuron 50W	(.5 lb a.i./A)	+ Surfactant	(.25%)	Post D
13	A	Weedy Check				
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D

*Preplant incorporated or preemergence treatment of each main plot.

**Post directed or over-the-top treatments of one half of each main plot.

***Preplant incorporated

****Over-the-top treatment of 1- to 5-inch tall sicklepod.

*****Post directed

******Preemergence

Conclusions

Over-the-top treatments for sicklepod have a place in soybean production, but there are problems. Over-the-top treatments (toxaphene plus bentazon and toxaphene plus Dyanap® excepted) increased soybean yields but not nearly as much as did the post directed treatments. Timing of over-the-top treatments is more critical than for post directed treatments because sicklepod plants must be less than 2 inches tall for dependable kill. Also, over-the-top treatments are weed specific; i.e., they kill sicklepod but do not kill other broadleaf weeds in some instances and are in no way detrimental to grasses. They also can suppress soybean growth and yield.

The combination of treatments that gave the most consiste control of sicklepod in these trial was the preplant incorporation c pendimethalin (0.5 lb ai/acre) plu metribuzin (0.25 lb ai/acre) follow ed by a preemergence applicatio of metribuzin (0.25 lb ai/acre) and post directed application o metribuzin (0.25 lb ai/acre).

Table 3. Design of a herbicide trial for control of sicklepod in soybeans, MAFES South Mississippi Branch, 1980.

1	A*	Pendimethalin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A	Pre I***
	B**	Toxaphene 8E	(3.0 lb a.i./A)			OT****
2	A	Pendimethalin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre I
	B	Toxaphene 8E	(1.0 lb a.i./A)	+ Dynap 3E	(1.5 lb a.i./A)	OT
3	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.5 lb a.i./A)	Pre E*****
	B	Linuron 50W	(.5 lb a.i./A)	+ Surfactant	(.25%)	Post D******
4	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.25 lb a.i./A)	Pre E
	B	Toxaphene 8E	(1.0 lb a.i./A)	+ Dynap 3E	(1.5 lb a.i./A)	OT
5	A	Alachlor 4E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.5 lb a.i./A)	Pre E
	B	Toxaphene 8E	(3.0 lb a.i./A)			OT
6	A	Metolachlor 6E	(2.0 lb a.i./A)	+ Metribuzin 4L	(.5 lb a.i./A)	Pre E
	B	Toxaphene 8E	(3.0 lb a.i./A)			OT
7	A	Alachlor 4E	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre
	B	Paraquat 2 CL	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
8	A	Alachlor 4E	(.25 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25 %)	Post D
9	A	Alachlor 4E + cultivation	(2.5 lb a.i./A)	+ Metribuzin 4L	(.375 lb a.i./A)	Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
10	A	Pendimethalin 4E	(.5 lb a.i./A)	+ Metribuzin 4L	(.25 lb a.i./A)	Pre I
		+ Metribuzin 4L	(.25 lb a.i./A)			Pre E
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
11	A	Cultivate				
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
12	A	Hand Hoed				
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D
13	A	Weedy Check				
	B	Metribuzin 4L	(.25 lb a.i./A)	+ Surfactant	(.25%)	Post D

*Preplant incorporated or preemergence of each main plot

**Post directed or over-the-top treatment of one half of each main plot

***Preplant incorporated

****Over-the-top treatment of 1- to 5-inch tall sicklepod.

*****Preemergence

******Post directed

Table 4. Yield of soybeans in herbicide trials for control of sicklepod, by year and by treatment, MAFES South Mississippi Branch, 1978, 1979 and 1980[1].

Main Plots	Yield							
	1978		1979		1980		1978-80 Av.	
	A*	B**	A*	B**	A*	B**	A*	B**
	bu/a							
1	35.9	40.8	24.2	28.7	19.8	20.9	-***	-
2	36.2	39.9	26.5	25.1	17.2	13.0	-	-
3	24.2	30.5	20.7	27.3	21.0	24.0	22.0	27.3
4	32.0	43.2	23.2	27.4	19.1	19.2	-	-
5	39.6	45.8	21.2	27.2	19.8	24.9	-	-
6	37.2	45.8	21.4	27.0	23.7	27.0	-	-
7	33.6	44.2	25.8	25.7	21.7	23.5	27.0	31.2
8	39.2	41.5	26.3	38.3	23.8	25.5	29.8	35.1
9	26.7	36.0	29.7	35.3	23.6	23.2	-	-
10	39.8	50.0	27.8	35.0	24.4	26.9	30.7	37.3
11	35.2	27.4	24.4	20.9	12.3	14.9	21.3	23.7
12	40.7	42.9	28.3	39.7	19.7	17.7	29.6	33.4
13	19.0	39.7	23.4	26.4	13.3	14.1	18.5	26.7
Av	33.8^{b}	40.6^{a}	24.8^{b}	29.5^{a}	20.0^{b}	21.2^{a}		

[1] Key yields to treatments by referring to Tables 1, 2 and 3. For example, the 27.4 bu/acre on line four under 1979 B resulted from Alachlor 4E at 2.0 lbs a.i./acre + metribuzin 4L at .375 lb a.i./acre applied preemergence followed by over-the-top application of Toxaphene 6E at 1.0 lbs a.i./acre plus Acifluorfen 2S at .375 lbs a.i./acre.

*Preplant incorporated or preemergence treatment of each main plot.

**Post directed or over-the-top treatments of one half of each main plot.

***Blank (-) indicates same treatment not applied each year.

Literature Cited

1. Worsham, A. D. and H. G. Small, Jr. 1968. "Soybean Weed Control on Farm Tests in North Carolina in 1967." *Proc. South. Weed Conf.* 21: 92-99.

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Mississippi Hybrid Corn Performance Trials in 1981

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in cooperation with

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1878

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Mississippi Hybrid Corn Performance Trials in 1981

Trials are conducted annually in ississippi to provide farmers, eedsmen, county agents and other terested persons with informa- on on the performance of commer- ally available corn hybrids. esults of the trials are provided r use by corn producers in selec- ng hybrids suited to their area. ew hybrids may be compared ith familiar hybrids.

Corn hybrids respond differently variations in environment, and a iven hybrid is not always the best nder all conditions. Therefore, it is uggested that corn producers row two or more good hybrids ach year. This practice also educes the chances for spread of a isease or insect infestation through the total corn acreage.

The yield of harvestable, good-quality grain (or silage) determines the desirability of corn hybrids. However, attributes other than yield may be extremely important in some instances. For example, resistance to a particular disease should be the prime consideration in areas where the disease occurs. That is, hybrids selected should be from those known to have resistance to diseases found in a geographic area.

All producers and/or distributors of seed corn are eligible to enter hybrids in these tests. Hybrids can be entered for testing in Area 1 (northern Mississippi), Area 2 (southern Mississippi) or both. The producers designate the hybrids they want entered in each area. Hybrids must be submitted for entry to the Mississippi Agricultural and Forestry Experiment Station by Feb. 15. A nominal fee is charged for each hybrid tested in each area to help defray costs of the tests.

Three or more tests were located in each area. Trials were conducted at eight locations in 1981 (Table 1).

The best guide to the desirability of a hybrid is its performance over a period of years at a number of locations. Therefore, three-year summaries are reported for each area.

Table 1. Location, number of entries and dates of planting and harvest of hybrid corn performance trials in Mississippi, 1981.

County	Location	No. of entries	Planting date	Harvest date
Marshall	Holly Springs	45	April 16	Sept. 17
Pontotoc	Pontotoc	45	March 25	Sept. 9
Lee	Verona	45	March 30	Sept. 14
Noxubee	Brooksville	45	April 14	Sept. 18
Oktibbeha	Mississippi State	45	April 13	Sept. 21
Newton	Newton	54	March 18	Aug. 14
Hinds	Raymond	54	March 12 & April 15	---
Pearl River	Poplarville	54	March 3	Aug. 6

Materials and Methods

Hybrids were tested at two population levels. The design was a randomized complete block with three replications. All tests were overplanted and later thinned to either 16,000 or 22,000 plants per acre, stand permitting. Each plot consisted of two rows, 38 inches apart and 200 inches long. Fertilizer was applied by each cooperator as he thought necessary, and weeds were controlled by cultivation and herbicides.

All tests were harvested with mechanical picker-sheller. Gra harvested from each plot w weighed, and moisture content w determined. All weights were co verted to bushels per acre at 15.5 moisture.

Results

Area 1.

Dry weather prevailed during the growing season in 1981. However, timely rains at some locations and one irrigation at Mississippi State provided enough moisture that yields averaged over all hybrids, both plant populations and all test sites were about 90 bu/acre. Variability of hybrid response within the lower plant population level at Holly Springs and Verona prevented detection of statistically significant differences ($P<.05$) among the hybrids, and these data are not reported. The average yield of 88.5 bu/acre for all hybrids at 16,000 plants per acre (Table 2) reflects average yields of 69.9, 107.8 and 87.7 bu/acre at Pontotoc, Mississippi State and Brooksville, respectively. Root lodging was of no importance except for some early root lodging at Brooksville. Stalk lodging was 11% or less at Brooksville but ranged from 4 to 44% at Pontotoc and from 7 to 53% at Mississippi State. Stalk lodging averaged over the three locations ranged from 5 to 13%.

The average yield of 96.1 bu/acre for all hybrids tested at 22,000 plants per acre (Table 3) reflects average yields of 102.2, 62.1, 121.1, 108.3 and 86.9 bu/acre at Holly Springs, Pontotoc, Verona, Mississippi State and Brooksville, respectively. Root lodging occurred only at Brooksville, and multiplying the root lodging presented in Table 3 by five gives a reasonably good estimate of root lodging at Brooksville. Stalk lodging occurred at all locations, but the smalle amount was at Holly Spring Stalk lodging averaged over th five locations ranged from 6 to 28%

Average yields at Pontotoc, Mi sissippi State and Brooksville we 88.5 and 85.8 bu/acre for plan population levels of 16,000 an 22,000 plants per acre, respectivel Thus, when considering al hybrids, these two plant popul tion levels resulted in essentiall the same level of production.

The three-year average yields the 16 hybrids that have bee tested for three years at 16,00 plants per acre ranged from 64 to 8 bu/acre (Table 4). The three-yea average yields for the same hybrid at 22,000 plants per acre range from 68 to 84 bu/acre (Table 5).

Area 2.

Stand problems were encountered in the first planting at Raymond, and drought stress was very severe in the second planting. Therefore, the test at Raymond was not harvested. Stand problems of a lower magnitude also were encountered at Poplarville and Newton, and plant population levels of many of the hybrids were less than desirable. This was particularly true at the higher plant population level.

The average yield of 67.3 bu/acre (Table 6) reflects average yields of 49.8 and 84.9 bu/acre at Newton and Poplarville, respectively. The 47 to 80 bu/acre yield range (averages for the two locations) reflects hybrid response and, to a lesser extent, may reflect differences in stands. Essentially no root lodging was observed, and stalk lodging ranged from 0 to 22% for the hybrids tested.

Yields from all hybrids tested at 22,000 plants per acre averaged 52.1 and 78.4 bu/acre at Newton and Poplarville, respectively. The average over the two locations of 65.3 bu/acre (Table 7) for this plant population level was 2 bushels less than at the lower plant populatio level. Stalk lodging ranged from to 26%. Stand percentages range from 64 to 90. Thus, the actua plant populations for the hybrid ranged from 14,080 to 19,800.

The three-year average yields o the 20 hybrids that have been tested for three years at 16,00 plants per acre ranged from 57 to 7 bu/acre (Table 8). The three-yea average for the same hybrids a 22,000 plants per acre ranged from 53 to 71 bu/acre (Table 9).

Table 2. Summary of performance of 45 hybrids grown at three locations (Pontotoc, Mississippi State, and Brooksville) at 16,000 plants per acre in the 1981 Mississippi hybrid corn performance trials.

			Lodging		Ear	Mois-	
Hybrid	Brand	Yield	root	stalk	height	ture	Stand
no.		bu/A	%	%	cm.	%	%
8150	McCurdy	103.7	2	8	115	12.9	104
G-4740	Funk's	102.3	2	10	101	13.7	99
8230	McCurdy	102.2	0	5	112	14.0	108
19A	Coker	100.3	0	9	105	12.9	97
G-4733	Funk's	100.3	0	5	111	13.6	101
G-4507A	Funk's	97.6	2	11	102	13.2	99
3147	Pioneer	95.9	2	18	118	13.4	92
G-4848A	Funk's	95.0	1	11	108	14.1	96
PX87	Northrup King	95.0	1	17	112	13.6	102
19	Coker	94.6	1	11	98	13.2	95
USS1010	Agri-Chemical	94.5	2	8	107	13.4	99
3369A	Pioneer	93.6	0	15	96	13.3	93
T1230	Trojan	92.9	0	21	110	13.2	103
USS0555A	Agri-Chemical	92.3	1	6	96	13.3	97
PX95	Northrup King	91.7	8	20	116	13.4	99
RA1504	Ring Around	91.6	2	9	104	13.2	105
508	McNair	91.4	4	21	133	14.4	107
XL71	DeKalb	90.6	1	11	103	13.2	102
G-4747-W-1	Funk's	89.6	2	16	115	14.0	97
SX373	P-A-G	89.0	2	11	107	13.9	98
G-4522	Funk's	88.7	1	15	97	13.3	92
21	Coker	88.7	0	22	109	13.8	98
XL394	DeKalb	88.5	4	14	122	14.2	108
XL395A	DeKalb	88.0	3	6	114	13.5	109
84aa	McCurdy	87.8	0	14	99	13.7	94
56	Coker	87.6	0	15	112	14.6	103
PX79	Northrup King	87.1	6	11	105	13.2	94
PX707	Northrup King	86.9	6	13	114	13.2	104
3160	Pioneer	86.8	0	13	108	13.9	101
RA1604	Ring Around	85.8	1	26	114	14.0	95
G-4689	Funk's	85.6	1	22	96	13.3	94
XL72B	DeKalb	85.1	2	9	97	13.6	99
SX351	P-A-G	85.0	3	19	106	13.1	102
519	Pioneer	83.8	4	18	125	13.7	102
T-E6970	Taylor-Evans	82.5	0	13	102	13.2	95
77B	Coker	81.5	6	21	125	13.2	99
G-795W	Funk's	81.0	6	18	118	13.4	99
PX83	Northrup King	80.9	7	17	103	13.9	104
XL72bb	DeKalb	80.7	0	10	102	13.3	96
XL390B	DeKalb	79.7	3	30	120	13.7	96
22	Coker	76.8	1	22	108	13.2	97
X-300	McNair	76.7	1	31	97	13.5	95
PX723	Northrup King	75.7	5	20	109	13.9	96
3179	Pioneer	75.5	1	22	105	13.0	88
XL61	DeKalb	69.8	0	24	87	13.2	91
Mean		88.5	2	15	108	13.5	99

CV = 15.61%
LSD(.05) = 12.8 bu/A

Table 3. Summary of performance of 45 hybrids grown at five locations (Holly Springs, Pontotoc, Verona, Mississippi State, and Brooksville) at 22,000 plants per acre in the 1981 Mississippi hybrid corn performance trials.

Hybrid no.	Brand	Yield bu/A	Lodging root %	Lodging stalk %	Ear height cm.	Moisture %	Stand %
8230	McCurdy	113.2	2	7	120	15.5	103
8150	McCurdy	111.7	1	10	124	14.9	99
G-4733	Funk's	107.7	2	11	114	15.0	94
84aa	McCurdy	106.9	0	15	112	15.1	95
USS1010	Agri-Chemical	106.3	2	12	112	14.4	96
19	Coker	105.4	1	12	107	14.0	93
G-4848A	Funk's	104.3	1	6	115	15.5	94
3147	Pioneer	104.1	3	14	122	15.1	90
PX87	Northrup King	104.0	0	18	119	15.4	96
21	Coker	102.9	1	17	119	14.4	95
SX351	P-A-G	101.4	3	17	116	14.3	99
T1230	Trojan	100.8	1	18	112	14.3	98
19A	Coker	100.5	1	16	117	14.4	94
XL395A	DeKalb	100.2	1	6	122	15.7	98
XL71	DeKalb	99.9	1	19	110	14.6	93
3160	Pioneer	99.8	2	18	118	15.5	92
G-4522	Funk's	99.6	1	10	103	13.7	93
G-4740	Funk's	99.5	4	13	110	15.1	96
USS0555A	Agri-Chemical	99.3	1	13	107	13.9	91
XL72B	DeKalb	98.6	3	12	109	14.2	97
XL394	DeKalb	98.6	4	14	127	14.7	95
519	Pioneer	96.9	5	16	133	14.4	88
PX95	Northrup King	96.5	6	17	127	14.5	93
XL72bb	DeKalb	96.4	6	10	112	14.2	96
508	McNair	96.1	2	19	136	15.6	95
3369A	Pioneer	95.9	1	22	108	14.8	94
G-4747-W-1	Funk's	95.5	6	22	125	15.3	97
PX79	Northrup King	95.2	2	11	117	13.7	93
SX373	P-A-G	95.2	4	14	113	14.4	93
RA1604	Ring Around	95.0	1	18	117	15.3	94
G-4507A	Funk's	94.7	1	14	109	14.8	94
G-4689	Funk's	91.0	2	20	109	14.5	90
PX83	Northrup King	91.0	7	18	110	13.9	95
XL61	DeKalb	89.6	1	15	93	14.4	91
X-300	McNair	89.0	1	28	106	14.7	89
RA1504	Ring Around	88.7	2	12	110	14.7	99
XL390B	DeKalb	87.8	2	23	128	14.6	91
PX707	Northrup King	87.1	6	15	120	14.6	95
PX723	Northrup King	86.9	3	25	117	14.5	92
56	Coker	86.7	0	17	121	15.3	98
77B	Coker	85.8	2	17	135	15.6	92
22	Coker	82.6	2	25	114	15.0	92
3179	Pioneer	80.2	2	27	118	14.7	91
T-E6970	Taylor-Evans	79.0	2	9	115	14.9	92
G-795W	Funk's	78.5	8	26	125	15.3	92
Mean		96.1	3	16	116	14.7	94

CV = 15.30%

LSD(.05) = 10.5 bu/A

Table 4. Three year (1979-81) average performance of 16 hybrids grown in Area I at 16,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid No.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk	Moisture	Stand
		bu/A	%	%	cm	no.	%	%
3147	Pioneer	84.8	8	15	116	71	16.3	95
G-4740	Funk's	82.2	5	13	100	75	16.8	98
84aa	McCurdy	80.7	3	11	103	69	15.7	95
3369A	Pioneer	80.3	6	10	122	71	15.4	96
19	Coker	78.3	6	8	105	69	15.1	97
USS1010	Agri-Chemical	77.3	9	8	127	74	15.7	96
PX87	Northrup King	75.1	3	12	110	73	16.4	97
56	Coker	74.1	3	14	117	76	17.2	100
22	Coker	73.0	6	9	110	71	16.0	95
PX95	Northrup King	72.9	12	16	120	76	16.2	94
3179	Pioneer	72.7	9	14	112	70	15.8	95
PX79	Northrup King	72.1	14	7	108	69	15.4	96
PX707	Northrup King	71.5	11	10	132	77	16.0	98
XL390B	DeKalb	71.0	6	19	143	67	16.6	95
XL394	DeKalb	70.1	11	11	124	76	16.7	102
PX723	Northrup King	64.2	10	13	115	76	16.3	100
Mean		75.0	8	12	117	73	16.1	97

Table 5. Three year (1979-81) average performance of 16 hybrids grown in Area I at 22,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid No.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Days to mid silk	Moisture	Stand
		bu/A	%	%	cm	no.	%	%
3147	Pioneer	84.2	8	16	118	78	16.2	92
84aa	McCurdy	83.2	3	12	109	73	16.3	96
19	Coker	81.4	7	13	107	70	14.9	93
USS1010	Agri-Chemical	81.3	10	10	107	73	15.0	95
G-4740	Funk's	80.2	8	13	103	76	16.4	94
PX87	Northrup King	79.0	7	12	108	76	16.4	95
XL394	DeKalb	78.4	10	12	125	80	16.7	92
3369A	Pioneer	77.5	7	15	106	75	15.2	94
PX79	Northrup King	75.9	11	8	113	75	14.9	95
22	Coker	73.0	4	15	109	73	16.0	93
PX95	Northrup King	70.9	11	13	123	77	15.6	94
PX723	Northrup King	69.7	9	15	117	75	17.7	93
56	Coker	69.7	5	15	118	76	16.7	94
XL390B	DeKalb	69.2	7	16	120	76	16.1	90
3179	Pioneer	68.7	6	20	117	75	16.0	92
PX707	Northrup King	67.8	10	12	115	75	15.8	96
Mean		75.6	8	14	114	75	16.0	94

Table 6. Summary of performance of 54 hybrids grown at two locations (Newton and Poplarville) at 16,000 plants per acre in the 1981 Mississippi hybrid corn performance trials.

Hybrid	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
no.		bu/A	%	%	cm.	%	%
UC12052A	Paymaster	80.1	2	2	94	20.1	93
3160	Pioneer	80.0	0	3	86	16.3	95
G-4733	Funk's	79.7	0	3	81	17.6	97
G-4747-W-1	Funk's	79.5	0	5	93	17.9	97
XL71	DeKalb	78.9	0	3	82	17.2	103
XL395A	DeKalb	78.5	0	8	94	18.9	92
19	Coker	75.1	0	7	78	15.4	90
USS2020	Agri-Chemical	74.8	0	8	90	18.6	92
G-4522	Funk's	74.2	0	5	77	15.7	87
UC9532	Paymaster	73.7	0	2	89	19.4	96
3040	Pioneer	73.2	0	2	93	18.4	94
SX373	P-A-G	73.1	0	8	87	17.9	92
21	Coker	73.0	1	14	88	18.1	95
UC8951	Paymaster	72.8	0	7	86	16.8	90
519	Pioneer	72.6	1	5	94	16.3	90
19A	Coker	72.6	0	5	88	15.4	99
G-4507A	Funk's	72.2	0	4	86	14.7	93
G-4740	Funk's	72.0	0	4	77	18.0	90
67-14	McCurdy	71.7	1	12	88	19.7	80
8150	McCurdy	71.5	0	3	91	16.1	92
3320	Pioneer	71.3	0	2	81	17.1	87
3147	Pioneer	69.4	2	7	85	16.8	89
XL390B	DeKalb	69.1	4	6	101	18.0	90
84aa	McCurdy	69.0	0	8	85	17.3	90
3030	Pioneer	68.5	0	7	95	19.6	102
UC7251	Paymaster	68.4	0	14	79	15.2	89
PX79	Northrup King	67.8	0	1	89	15.4	95
508	McNair	67.8	0	10	104	20.0	97
PX87	Northrup King	66.9	1	12	86	15.7	93
XL394	DeKalb	66.8	2	2	94	17.8	94
G-4689	Funk's	66.7	0	8	78	17.3	90
USS1516	Agri-Chemical	66.5	0	8	79	16.3	92
77B	Coker	66.4	1	9	102	20.1	90
T1230	Trojan	66.2	1	18	87	17.8	92
22	Coker	65.8	0	10	86	18.7	96
UC9902	Paymaster	65.1	0	16	94	18.0	92
PX707	Northrup King	64.7	0	7	90	17.5	93
3369A	Pioneer	64.3	2	8	78	16.3	87
X-300	McNair	64.1	0	6	83	18.1	93
G-4848A	Funk's	63.6	0	1	79	20.5	77
56	Coker	62.4	0	9	92	18.1	93
PX95	Northrup King	62.1	0	1	98	18.4	90
PX83	Northrup King	61.9	0	10	84	16.1	86
G-795W	Funk's	61.4	1	16	93	19.8	86
G-4949A	Funk's	60.6	1	7	94	20.6	96
RA1504	Ring Around	59.4	0	7	83	15.3	89
T-E6970	Taylor-Evans	58.9	1	22	80	16.7	87
G-5945	Funk's	58.9	0	6	99	19.2	90
PX723	Northrup King	56.5	1	5	96	18.0	86
RA1604	Ring Around	56.1	1	15	84	17.7	82
XL72B	DeKalb	52.6	0	3	78	16.4	84
SX351	P-A-G	50.4	1	18	84	15.1	82
XL72bb	DeKalb	49.7	0	9	79	15.9	77
XL61	DeKalb	47.1	0	9	68	16.6	81
Mean		67.3	1	8	87	17.5	91

CV = 16.49%
LSD(.05) = 12.6 bu/A

Table 7. Summary of performance of 54 hybrids grown at two locations (Newton and Poplarville) at 22,000 plants per acre in the 1981 Mississippi hybrid corn performance trials.

Hybrid no.	Brand	Yield bu/A	Lodging		Ear height cm.	Moisture %	Stand %
			root %	stalk %			
G-4733	Funk's	83.5	0	3	86	18.3	82
3160	Pioneer	80.1	6	5	88	17.6	81
XL395A	DeKalb	79.1	1	4	97	20.1	86
UC9532	Paymaster	75.5	1	8	87	17.6	87
G-4740	Funk's	75.3	3	5	78	18.9	87
USS2020	Agri-Chemical	74.2	0	3	92	18.1	75
SX373	P-A-G	73.7	0	9	93	17.4	87
3147	Pioneer	73.3	0	12	88	17.1	88
PX87	Northrup King	73.3	2	14	81	18.6	90
G-5945	Funk's	72.5	2	9	96	18.1	87
3030	Pioneer	72.4	2	5	100	20.1	90
UC8951	Paymaster	71.7	0	9	88	17.7	90
8150	McCurdy	71.4	0	8	95	17.8	88
RA1604	Ring Around	69.9	0	16	91	17.9	84
XL394	DeKalb	69.6	0	6	95	18.0	76
USS1516	Agri-Chemical	69.2	0	5	78	16.5	86
PX707	Northrup King	68.9	0	10	93	16.8	78
T1230	Trojan	68.6	0	9	83	18.4	76
508	McNair	67.9	1	11	99	21.5	75
19A	Coker	67.7	0	10	88	16.4	87
84aa	McCurdy	67.6	0	12	83	17.2	75
3040	Pioneer	67.0	1	3	86	19.4	85
XL71	DeKalb	66.8	0	16	82	16.6	75
19	Coker	66.5	6	3	83	15.9	79
G-4507A	Funk's	66.4	1	9	87	16.1	87
UC7251	Paymaster	66.4	0	27	79	14.6	74
519	Pioneer	66.3	1	8	101	16.7	89
PX79	Northrup King	65.7	0	1	85	15.5	85
22	Coker	65.7	0	16	85	17.4	72
PX95	Northrup King	65.2	1	7	94	18.5	83
PX723	Northrup King	64.7	0	7	97	17.4	84
G-4949A	Funk's	63.7	0	7	99	18.4	86
67-14	McCurdy	63.6	2	7	82	19.4	79
3320	Pioneer	63.5	1	6	86	16.6	79
UC12052A	Paymaster	63.0	4	7	90	22.5	76
UC9902	Paymaster	62.6	1	22	93	18.8	75
X-300	McNair	62.3	2	15	78	18.1	68
56	Coker	61.3	0	6	91	18.4	67
G-4848A	Funk's	60.8	0	4	84	21.4	66
G-4689	Funk's	60.7	1	7	76	16.8	79
77B	Coker	60.6	1	10	99	19.6	84
G-4522	Funk's	59.4	3	8	84	15.3	73
XL72bb	DeKalb	58.9	0	4	83	17.0	70
XL390B	DeKalb	58.7	1	20	98	18.1	82
PX83	Northrup King	58.5	0	8	88	17.0	79
RA1504	Ring Around	58.2	0	14	79	15.4	79
21	Coker	57.6	2	20	84	19.1	72
G-4747-W-1	Funk's	56.2	0	6	91	18.9	87
3369A	Pioneer	55.1	1	13	78	15.3	80
SX351	P-A-G	53.5	1	15	86	13.6	80
G-795W	Funk's	53.3	3	26	94	18.5	79
T-E6970	Taylor-Evans	50.9	2	13	86	17.7	81
XL72B	DeKalb	49.9	1	8	83	15.4	74
XL61	DeKalb	46.3	1	10	66	16.0	64
Mean		65.3	1	10	88	17.7	80

CV = 19.09%
LSD(.05) = 14.2 bu/A

Table 8. Three-year (1979-81) average performance of 20 hybrids grown in Area II at 16,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid No.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
		bu/A	%	%	cm	%	%
UC8951	Paymaster	73.5	2	6	98	17.5	98
3147	Pioneer	72.6	5	8	96	16.9	94
67-14	McCurdy	72.3	12	11	94	19.4	92
G-4740	Funk's	69.8	1	6	84	18.1	95
3030	Pioneer	69.8	7	9	101	19.5	100
84aa	McCurdy	69.3	2	8	93	16.9	96
19	Coker	67.3	1	5	87	15.8	93
3040	Pioneer	67.2	7	6	95	19.6	95
PX87	Northrup King	65.6	1	10	91	16.8	95
PX95	Northrup King	64.9	3	4	105	18.1	93
3369A	Pioneer	63.9	2	8	83	16.7	93
PX79	Northrup King	63.5	3	3	94	15.8	97
PX707	Northrup King	62.4	5	8	98	16.6	94
XL394	DeKalb	61.7	11	8	98	18.2	95
XL390B	DeKalb	61.6	5	17	107	17.9	90
22	Coker	60.7	1	10	89	17.5	95
G-4949A	Funk's	60.7	9	13	107	19.4	96
PX723	Northrup King	58.3	5	8	100	18.1	91
56	Coker	57.9	6	11	100	18.2	92
G-5945	Funk's	57.4	10	10	105	19.5	92
Mean		65.0	5	8	96	17.8	94

Table 9. Three-year (1979-81) average performance of 20 hybrids grown in Area II at 22,000 plants per acre in the Mississippi hybrid corn performance trials.

Hybrid No.	Brand	Yield	Lodging root	Lodging stalk	Ear height	Moisture	Stand
		bu/A	%	%	cm	%	%
3147	Pioneer	71.4	5	9	96	17.3	90
G-4740	Funk's	71.1	6	7	84	18.7	92
UC8951	Paymaster	68.3	3	8	94	16.8	92
19	Coker	67.5	9	6	90	16.0	90
84aa	McCurdy	66.6	3	14	90	16.9	87
PX87	Northrup King	66.5	4	15	89	17.1	93
3040	Pioneer	65.7	11	6	98	18.4	93
XL394	DeKalb	64.7	13	6	103	18.2	87
PX707	Northrup King	63.2	10	11	98	17.5	86
67-14	McCurdy	62.0	19	11	89	19.1	90
PX723	Northrup King	61.5	13	8	103	17.6	89
PX95	Northrup King	60.5	5	11	105	18.1	89
22	Coker	59.8	4	15	90	17.7	86
G-4949A	Funk's	59.4	12	10	105	19.7	92
3030	Pioneer	59.1	13	8	107	19.6	91
PX79	Northrup King	58.8	9	3	91	16.1	92
G-5945	Funk's	57.5	15	12	104	18.4	89
3369A	Pioneer	57.0	4	11	84	15.7	89
XL390B	DeKalb	53.1	9	19	106	18.4	89
56	Coker	52.8	5	14	99	19.3	83
Mean		62.3	9	10	96	17.8	89